Welding Design & Fabrication

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Complete coverage of the AWS 41st Annual Convention & Welding Show

APRIL 1960

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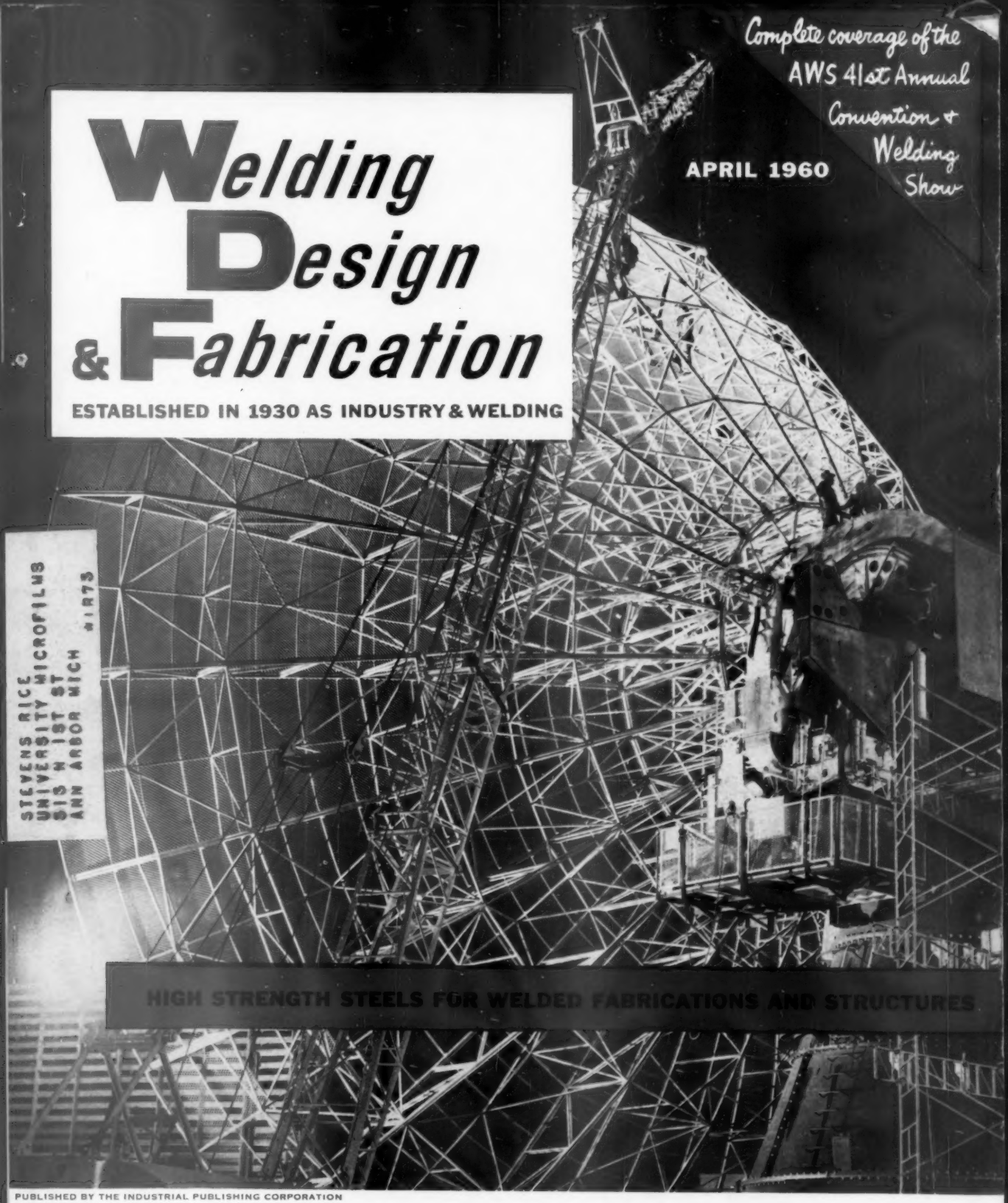

HIGH STRENGTH STEELS FOR WELDED FABRICATIONS AND STRUCTURES

PUBLISHED BY THE INDUSTRIAL PUBLISHING CORPORATION

ALSO IN THIS ISSUE

- ULTRASONIC INSPECTION OF TITANIUM WELDMENTS
- ROLL FORMING AND WELDING OF MISSILE BODY SHELLS
- INDUSTRY LEADERS APPOINTED TO EDITORIAL ADVISORY BOARD

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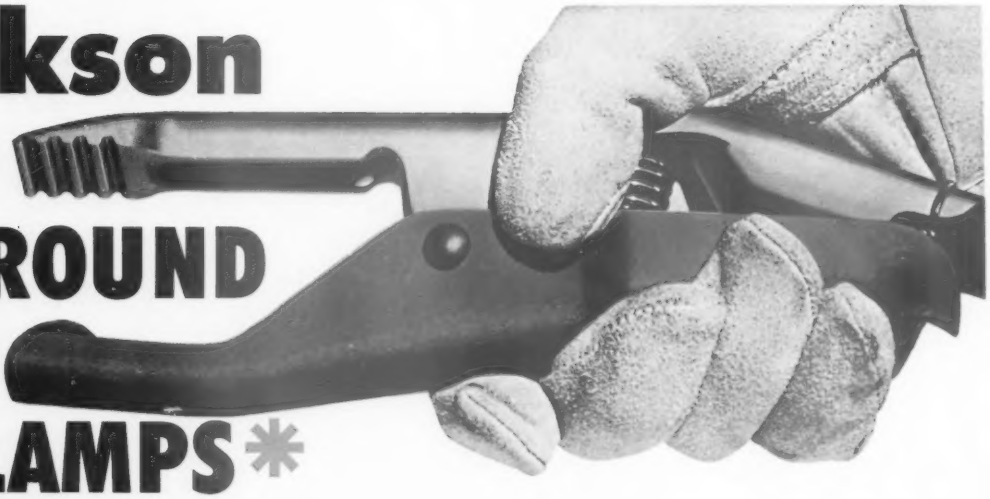
HOBART

Jackson GROUND CLAMPS*



CABLE CONNECTORS†

& CABLE LUGS

* Jackson Ground Clamps work easily and efficiently. One end fits the hand, with finger-grooved lower tong. Proper placement—current-carrying upper tong on top where you're sure of good contact—is natural and easy.

The business end fits the job. The contact area of the copper alloy upper tong is large and flat, with serrations that bite through surface film. Greater contact area carries current efficiently. New melamine-impregnated fiber glass insulators at pivot keeps current out of lower tong.

† Jackson 'Quik-Trik' Cable Connectors have streamlined Neoprene rubber insulators that lock out moisture, dirt, and don't catch on obstructions. Cable connects mechanically, or by soldering or brazing. The reduced tip diameter on the tapered plug takes hard knocks without forming a burr that will interfere with the mating of the halves.

Models to fit cable sizes 1 thru 4/0, sold everywhere by better welding supply dealers

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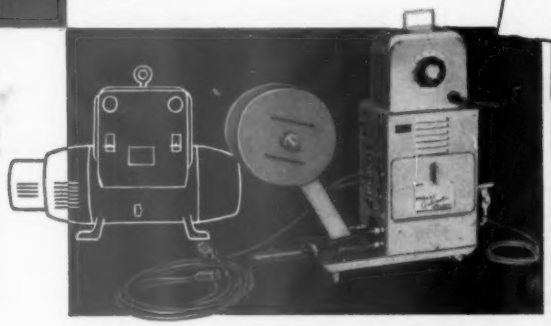
HOBART *Micro-wire* WELDING PROCESS . . . up to **50% faster** than older methods . . . and —much more versatile!

- Welds in **all positions**
- Welds **light and heavy gage** with minimum distortion
- Uses **inexpensive** CO_2 gas
- Permits welding **up to 200 amperes** DC on a 100% duty cycle

You get the feeling that this is a gun designed for action the instant you pick it up. It's so light—only 14 oz., fits so comfortably, maneuvers so easily, you hardly know it's in your hand. The gentle curve of its nozzle puts the *Micro-wire* exactly where you want it. A flick of the handy thumb switch starts gas flow and wire feed at a constant speed. It welds perfectly in places where it may not be possible to use stick electrodes. Spatter is practically non-existent. All connections to the gun are encased in a single flexible, lightweight, small diameter extruded jacket.

See this equipment at the A.W.S. WELDING SHOW April 26, 27, 28 Booth No. 318



This small easy-to-use "MIGARC" automatic wire feed control is the perfect companion to the *Micro-wire* gun. Permits wire feed speeds from 34" to 340" per minute.

Weld in all positions with the same speed and efficiency of flat position welding.

Eliminates cleanup time, electrode changing and costly stub end loss.

FOR MORE COMPLETE DETAILS on how Hobart's new *Micro-wire* welding process can profitably work for you . . . fill out and mail this coupon today.

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"Manufacturers of the world's most complete line of arc welding equipment"

HOBART BROTHERS CO., BOX HW-40, Troy, Ohio, Ph. FE 2-1223

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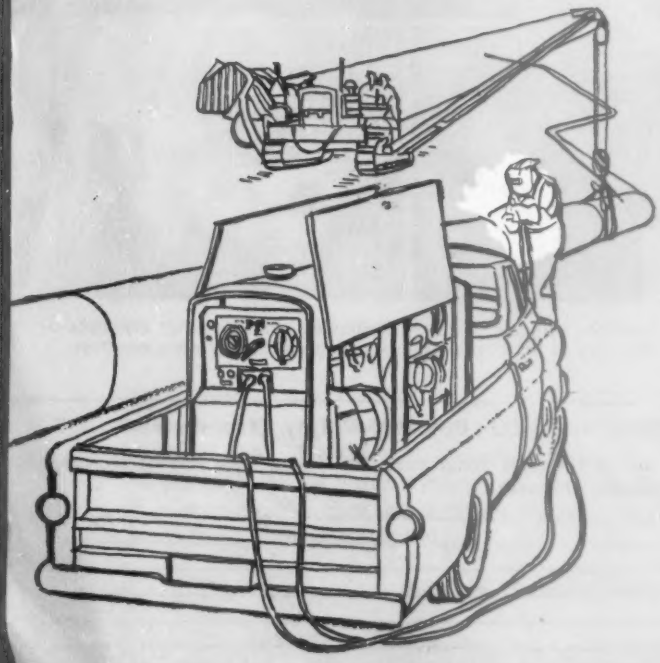

You can use these portable, self-contained welders to save time and work on any construction job *anywhere!* They are ideal for buildings, pipe lines, bridges, or maintenance — wherever you need cost-cutting weld-power to join and strengthen metal parts and sections. You simply haul, wheel, or hoist the welders into position and start welding.

P&H offers you six machines for welding requirements ranging from 25 to 500 amps. Easy, precise voltage control and arc stability enable operators to lay down sounder, cleaner welds faster — prevent burn-through and popouts, thus sparing you the need for costly rewelds and call-backs.

You don't have to pamper P&H welders. They're built to withstand hard use and rough handling in the field. They need less care — and they are easier to service. Rugged field-proved gas or diesel engines meet your toughest demands with power and fuel to spare.

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reader's guide to **Welding Design & Fabrication** *for April, 1960*

COVER: The welded yoke for this radar antenna was made from high-strength steels by Goodyear Aircraft Corp., Akron, Ohio. This reduced the yoke's weight about 25 percent—to about 44,000 pounds—without sacrificing strength. Originally, the yoke was scheduled to be made from 4130 normalized steel.

Turn to page 70 for complete details on the high-strength steels used and the low-alloy high tensile electrodes Goodyear used to weld them.

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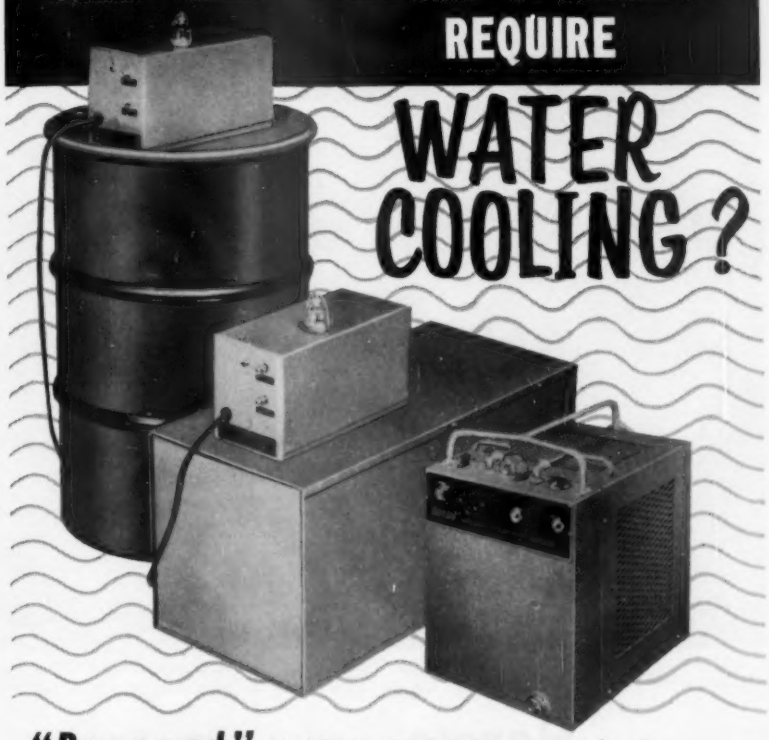
DOES YOUR WELDING EQUIPMENT REQUIRE

WATER COOLING?



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Lewis Welding & Engineering Company of Bedford, Ohio, welded this annulus for Clark Bros. Co. of Olean, New York, producers of industrial gas turbine engines.

Here's a dissimilar alloy weld that's reliable above 1000° F...

When this liner for an industrial gas turbine annulus is hooked up to a combustion chamber, it will face temperatures over 1000°F. That's how hot its metal surfaces get when they channel high temperature combustion gases toward whirling turbine blades.

The welding of these dissimilar alloy parts, one heavy, the other light, becomes really important when operating conditions are considered. Shutdowns are rare in industrial gas turbine service, and welds must last for years. But the Inco-Weld* "A" Electrodes used here eliminate the possibility of weld failure.

No heat problems

That's because the Inco-Weld "A" deposit is both ductile and strong. In all likely combinations, it is compatible with high-temperature-type base metals.

Inco-Weld "A" Electrode, remarkable for its ability to weld 97% of all dissimilar alloy combinations, is *equally remarkable* for its ability to provide dissimilar alloy joints capable of long-term resistance to heat and corrosion.

Operability is excellent

With Inco-Weld "A" Electrode it's easy to produce ductile X-ray quality welds. You can weld in all positions, the arc is spray-type, slag removal is good, and spatter is at a minimum.

Inco-Weld "A" Electrode is supplied in 3/32, 1/8, 5/32 and 3/16 inch diameters, packed in 5-lb sealed asphalt-lined containers for convenience and protection.

Plan to use Inco-Weld "A" Electrode the next time you weld dissimilar alloys. For information on the weld properties you can expect, write for our 6-page brochure, "Now You Can Weld 97% of All Dissimilar Alloy Combinations with One Electrode."

*Inco trademark

Combustion chamber liner is made of Inconel* nickel-chromium alloy and other high temperature alloys, production welded with Inco-Weld "A" Electrodes.

HUNTINGTON ALLOY PRODUCTS DIVISION

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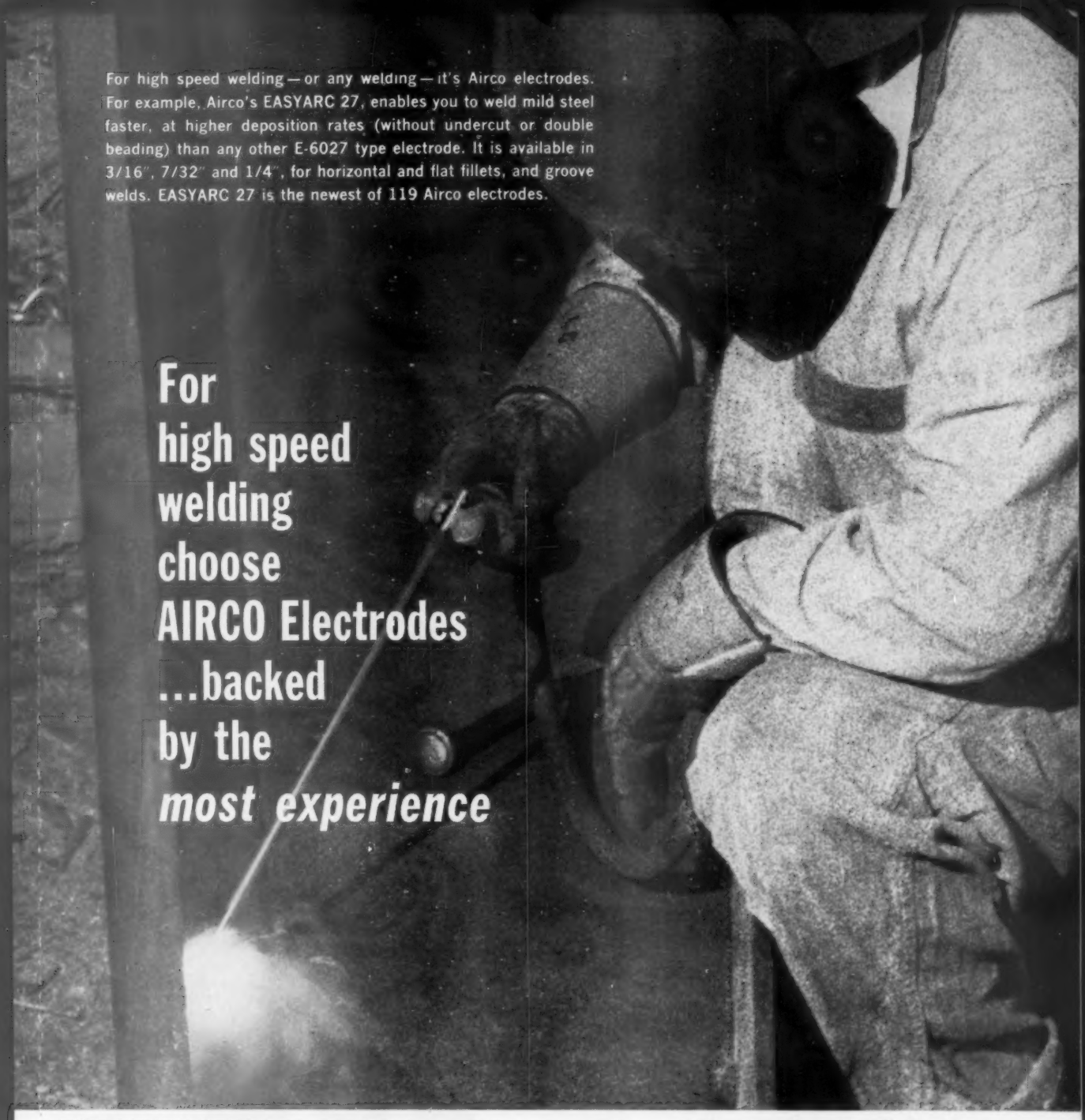

For high speed welding — or any welding — it's Airco electrodes. For example, Airco's EASYARC 27, enables you to weld mild steel faster, at higher deposition rates (without undercut or double beading) than any other E-6027 type electrode. It is available in 3/16″, 7/32″ and 1/4″, for horizontal and flat fillets, and groove welds. EASYARC 27 is the newest of 119 Airco electrodes.

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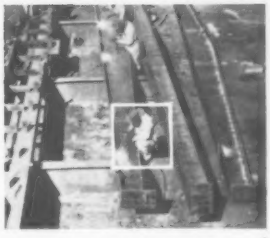

Do you weld ships . . . missiles . . . auto bodies . . . nuclear reactors . . . earth-movers? However specialized your welding may be, you'll find an Airco electrode designed to do it better.

For any electrode: stainless, mild steel, low alloy, low hydrogen, metal powder, aluminum, bronze, cast iron and hardfacing — phone your authorized Airco Distributor. Look in your Classified Telephone Directory under "Welding Equipment and Supplies" for the nearest Airco representative.

See Airco Booth 303, Welding Show, Los Angeles, April 26-28.

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MANY EXTRA FEATURES AT A DELIVERED COST UNDER $500

You get the cut quality and capacity of machines nearly three times as expensive when you use the new Model 1-A SEVER-ALL oscillating dry abrasive cut-off machine. Available from your distributor's stock. Here's why the #1-A SEVER-ALL is ideal for industrial and machine shop operations:

BIG CAPACITY • Up to 2″ square solids, 3½″ O. D. pipe and tubing, 3″ angle iron, and 4″ channels . . . of cold rolled, stainless, and alloyed steel; cast iron; and nonferrous metals. Wheel oscillation, an exclusive feature in this price range, provides this *above-average* capacity.

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SIMPLICITY • Just two SEVER-ALL cutting wheel specifications will do *all* your SEVER-ALL cutting jobs. A positive, screw-type vise holds all regular shapes, and an adjustable work stop provides speed and accuracy.

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Very likely your own distributor already stocks the Model 1-A SEVER-ALL machine and wheels. If not, let us know, and we'll give you the name of your nearest SEVER-ALL distributor. Also, we'll be glad to send you complete details on this new machine. Just ask for **Bulletin DH-106.**

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WELDING AT WORK

to do the job better and cheaper

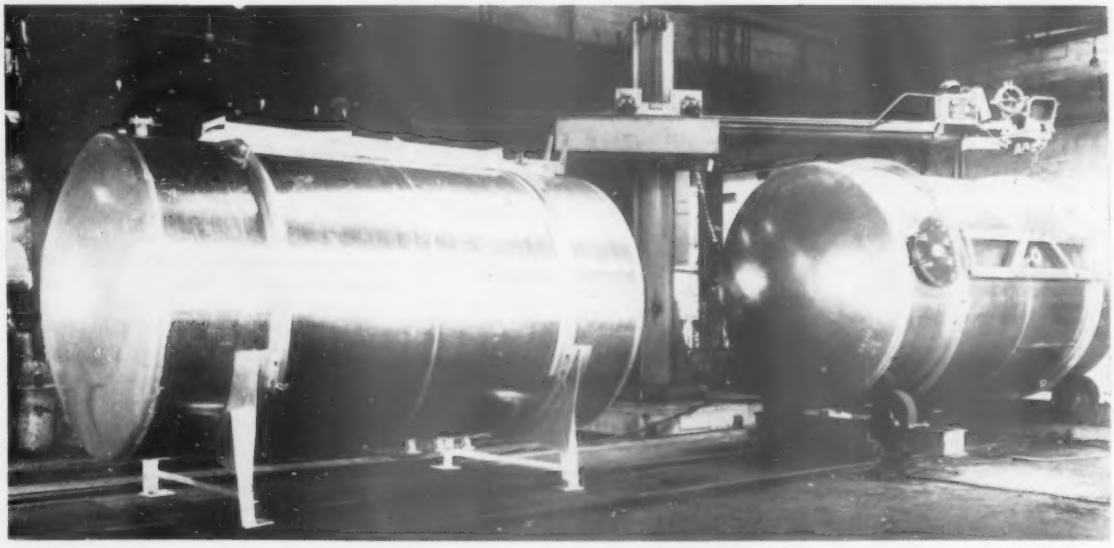
Welded aluminum dump body has larger payload

HUNTINGTON PARK, CALIF.: Eleven cubic yards can be carried in this welded aluminum dump body made by the Euclid Steel Fabricating Co., Inc. The 7- by 14-foot unit weighs only 1,400 pounds. It permits a payload increase of 1,500 pounds compared to the load of a steel unit of the same size.

According to Euclid, additional advantages are the unit's resistance to abrasion and denting and its ability to withstand corrosion. These features are said to result in impressive savings in maintenance and repairs.

The body shell and floor are made of high strength aluminum alloy 5083 plate supplied by Kaiser Aluminum & Chemical Corporation. A 5356 filler wire is used.

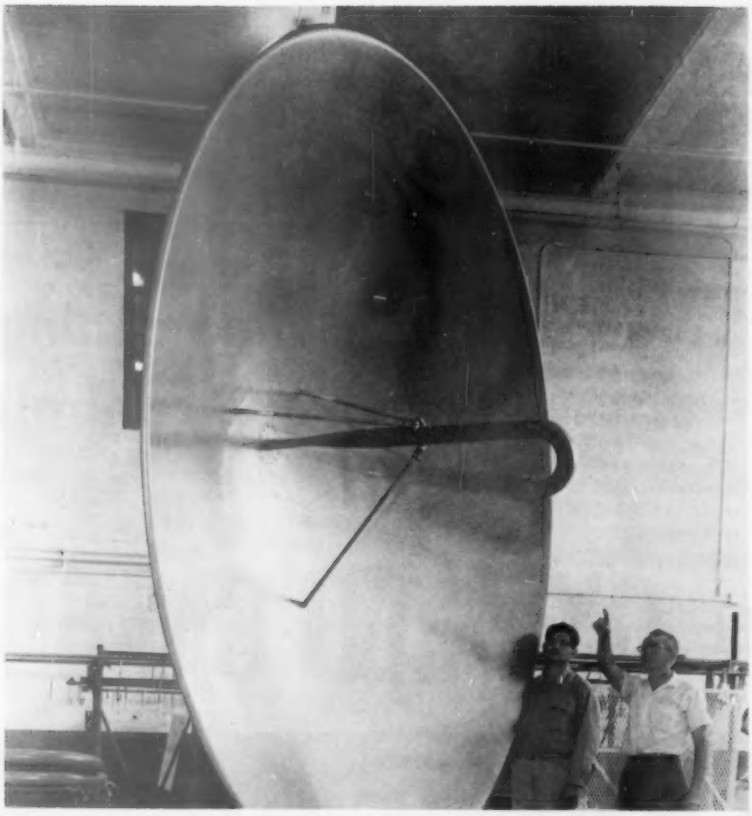
The dump pictured is furnished with Ford Model F800 power and may be equipped with any hydraulic hoist specified.



Manipulator speeds welding of giant aluminum tanks

PATERSON, N. J.: These giant aluminum tanks (20-feet long and 8-feet in diameter) were made at Paterson Boiler Co. using C. B. Herrick Mfg. Corporation's Model CB 15 x 20 manipulator. Tanks are welded with inert gas consumable electrode process (manipulator has dual head which also can be used for submerged arc welding).

Unit has 12-feet of motorized vertical adjustment (3- to 15-feet) and variable speed ram travel (5 to 100 ipm) of 20-feet.

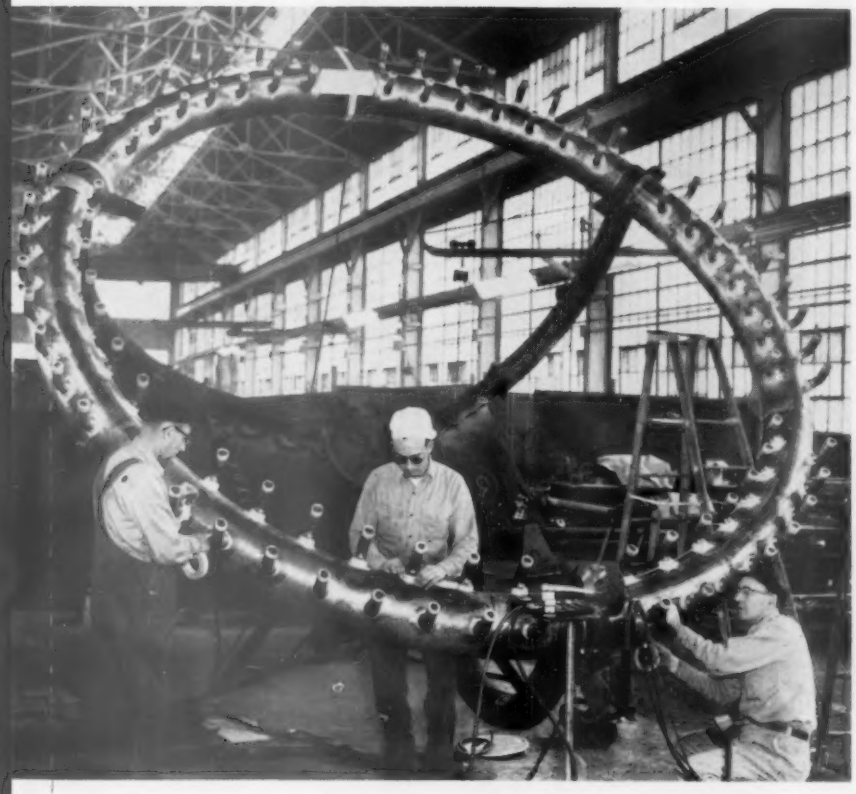


Radar antenna depends on two weldments

PHILADELPHIA, PA.: Storm-Finder radar antenna built here at the Special Products Division of I-T-E Circuit Breaker Co. will be installed at weather bureaus through the country.

Weldments are used in the sub-base assembly, which is used to support and level the antenna, and in the yoke assembly that supports the reflector, transmitter and feed support. One-half inch plate rolled to a 24-inch diameter with welded studs and flanges is used to support the sub-base. Six-inch diameter formed steel tubing is used in the yoke.

Although exact cost figures are not yet available, indications are that the weldments are cheaper than the ductile iron castings once considered for the job.



Reactor's outlet header has 90 welded connections

MARIETTA, OHIO: This outlet header for the new Hanford Recycle Test Reactor being built by General Electric at Richland, Washington, for the Atomic Energy Commission was fabricated by Dravo Corporation. The piping—Type 304 stainless, 10-¾ inches OD and .750 inch wall thickness—is in three segments which are welded together to form a 13½ foot diameter ring. Visible are the specially forged bull tees and some of the 90 welded 1½ inch outlets for connections to the water cooling lines.

Dravo, which furnished the material and fabricated both inlet and outlet headers, completed the complex job at its pipe fabricating shop in Marietta.

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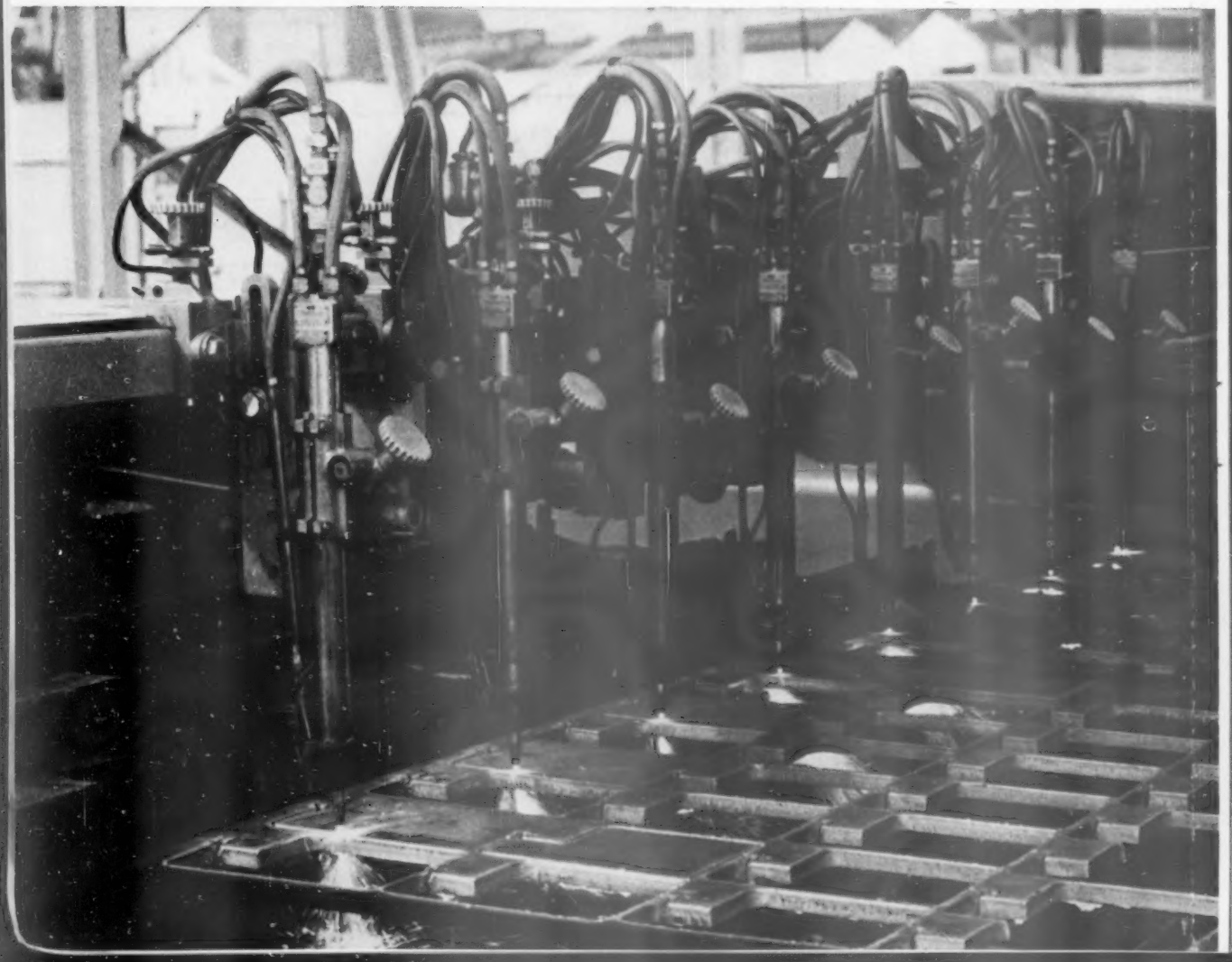


cutting machine with unlimited capacity!

Never before has any shape-cutting machine come so close to complete automation. The OXWELD CM-60 will reproduce thousands of metal parts from a simple exact-size pencil or ink drawing on ordinary paper. It requires only one operator, working at a single, centrally located control panel. Powered by a co-ordinate drive system the CM-60 is readily adaptable to all present and future methods of control including ratio cutting and punched or magnetic tape. Standard models are equipped with up to 10 torches to handle work up to 10 ft. wide. But capacity of the CM-60 is unlimited. Models can be made to cut greater widths. The length of sections that can be cut is limited only by the length of track used.

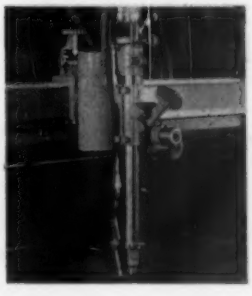
Complete fingertip control—Ignition, preheat, cutting oxygen, height adjustment of the torches, movement of the carriages, positioning of the tracer... every action can be controlled by flicking a switch or turning a dial. Remotely operated ignitors on each torch light preheat flames simultaneously. Piercing of plate is simplified by a unique pilot valve on the panel which turns on the cutting oxygen slowly and gradually to start a cut or pierce a hole. Gases are shut off automatically when cutting operations stop for any reason.

Superior construction features—The co-ordinate drive type CM-60 has power to spare. Each carriage has two individual motors—a high speed motor for positioning and a co-ordinate drive motor for accurate positive cutting. The co-ordinate drive motors are directed by a sine-cosine potentiometer. Only premium quality, durable materials are used throughout. Weight of the CM-60 on the guide tracks is borne at only three points so that the frame won't twist.

Get full details on the OXWELD CM-60 shape-cutting machine from your local LINDE office. Or, write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto 7, Ontario.

LINDE COMPANY UNION CARBIDE

Follows a pencil drawing... First and only tracer with built-in kerf adjustment—The photocell tracer never contacts the tracing table. There is no damage to drawings. You can use simple pencil or ink drawings, completely eliminating templates and their storage problems. In most shops this saving alone will pay for the new tracer in less than a year. Tracer accuracy is excellent—within ±.005 inch. Kerf widths up to ¼ in. can be easily adjusted for on the tracer. Drawing can be simply traced from engineering prints of the desired shape.



Any deviation in plate surface level is instantly sensed by an automatic height adjustment control unit. If there is any deviation in the plate surface the motorized torch holders react instantly, automatically lowering or raising the torch to compensate for the deviation. Cutting oxygen is automatically controlled by quick-acting solenoid valves on each torch to eliminate gouging after the cut is complete.

"Linde," "Oxweld" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

For More Information Circle No. 59 on Reader Service Card.

This way to quality...

Plan to visit our Booth 207, at the forthcoming AMERICAN WELDING SOCIETY'S 41st Annual Convention and Welding Exposition being held at the GREAT WESTERN EXHIBIT CENTER, Los Angeles, California—April 26 to 28—where you will see the many NEW items of our manufacture. One of the most versatile operators of the welding torch will be on hand to demonstrate his amazing artistry in hand cutting . . . a special section will be devoted to the demonstration of the latest in oxygen therapy equipment . . . and an experienced glass blower will put some of our air-gas apparatus through its paces. Many other programs of interest are scheduled for this contact booth, so come see us . . .

We look forward to greeting old friends . . . and hope to meet many new ones.

REMEMBER! BOOTH 207!

National® SINCE 1910 of . . . california

554 DEPT.

NATIONAL welding equipment company... 218 fremont street san francisco 5 california

For More Information Circle No. 74 on Reader Service Card.

Magnetic? OR Electronic? WELDER CONTROL — WHICH WILL DO YOUR JOB BEST?

Square D makes them all... for simplest or most exacting applications!

Magnetic

for General Purpose Machines

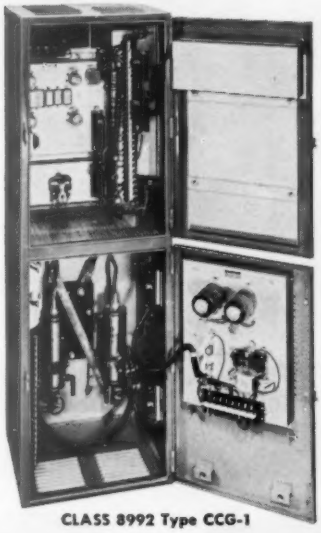
For applications requiring widely varying welding conditions, normal welding speeds and maximum simplicity.

CLASS 8992 Type BBG-1

Electronic

for High Speed Welding

For production line (gun or stationary) welders and other applications where high speed, high currents or dual gun control are factors.



CLASS 8992 Type CCG-1

Electronic (SYNCHRONOUS)

for Precision Welding

For welding aluminum, other non-ferrous and ferrous metals requiring precision weld times; stepless heat control; slope or taper control.

CLASS 8993 Type BDG-2

You'll find your nearby **Square D Field Engineer** *a source of sound counsel in selecting the welder control best suited to your application.*

SQUARE D COMPANY

wherever electricity is distributed and controlled

For More Information Circle No. 88 on Reader Service Card.

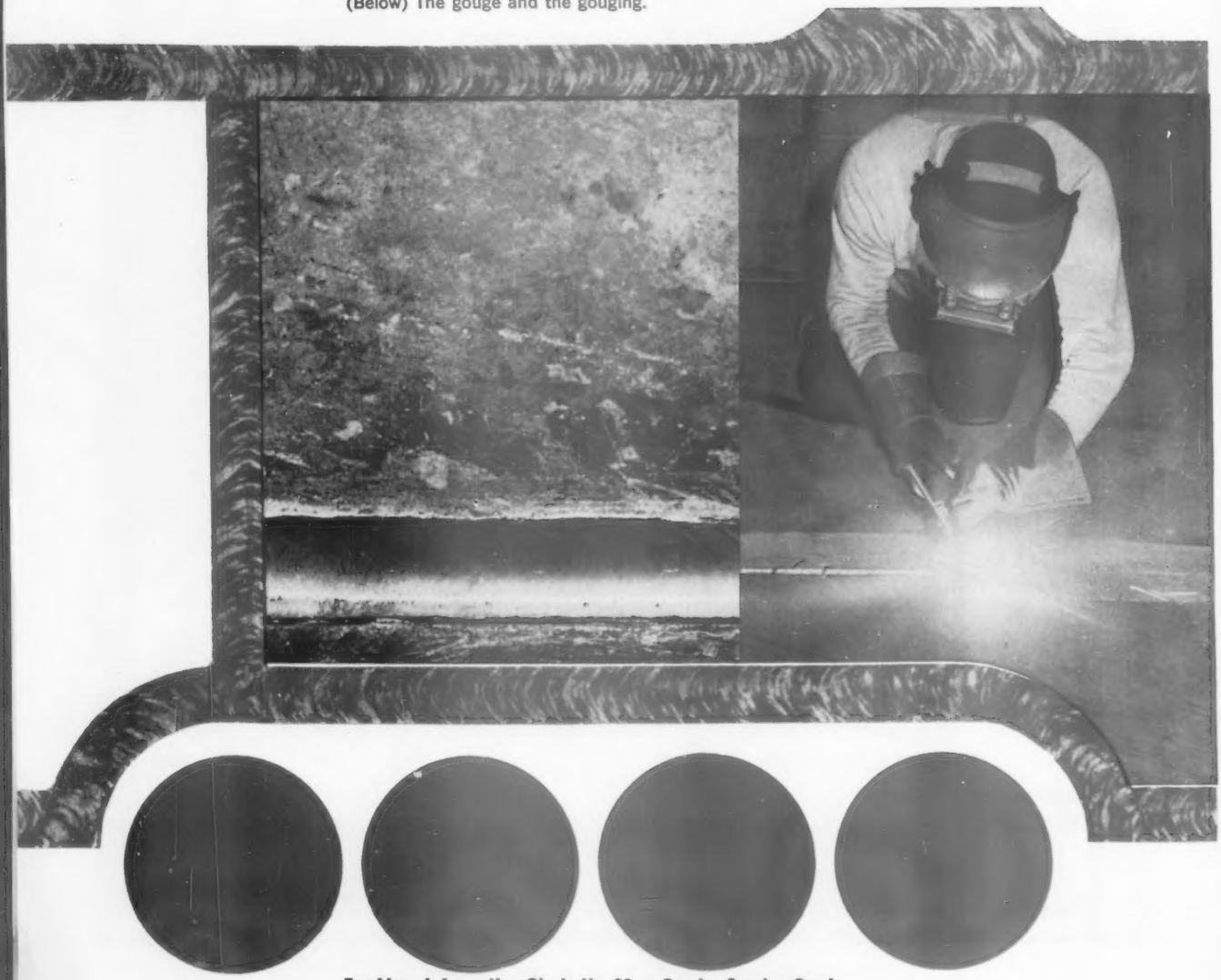
new Westinghouse WS silicon welder...

Arc-air gouging for metal removal offers an outstanding path to cost reduction. The new Westinghouse WS welder has been designed as the ideal companion to this process.

Weld or gouge—be SURE you do it with the 500-amp WS because, in addition to the natural advantages of a hermetically sealed, high capacity, silicon diode rectifier, it affords threefold protection.

Three automatic protection features eliminate the need for special precautions by the operator. First: an exclusive surge suppressor circuit to protect against transient voltage spikes. Second: an integral transformer thermal switch that prevents overheating with prolonged use. Third: an exclusive time and current sensing

(Below) The gouge and the gouging.



For More Information Circle No. 99 on Reader Service Card.

designed specifically for arc-air gouging, too!

relay circuit that prevents damage from the above normal current or above normal duty cycle.

You benefit with greater production and fewer repair bills. What's more, you have a dual-purpose unit that can both weld and arc-air gouge, a welder you can count on to work whenever you need it.

You can get other Westinghouse WS units with the same ruggedness and reliability. Capacities: 200, 300, 400 as well as 500 amps for 230/460-volt a-c operation.

Want more information on the industry's newest, most versatile welder? Contact your nearest Westinghouse Welding Distributor . . . or write Westinghouse Welding Division, 4454 Genesee Street, Buffalo 5, New York.

J-10483

watch Westinghouse for new developments in welding!

YOU CAN BE SURE...IF IT'S Westinghouse

The new WS welder.

SEE . . . . the Westinghouse exhibit in Booth 115 at the American Welding Society Show. . . . April 26, 27 and 28.

New Ampco Cable Connector

WON'T OVERHEAT...WON'T ARC

Patented twin-wedge design can't work loose

Maintains perfect electrical contact — No lugs, locks, hooks, or springs to loosen and cause arcing. With twin-wedge connections, the area of tight electrical contact actually increases with normal wear!

Joins all cable sizes — Ampco Cable Connector fits all four popular welding-cable sizes. When properly attached by lead soldering or crimping, the cable connector can get no hotter than the cable itself.

Safe — When properly mated, Ampco Cable Connector withstands the tension stress applied by dragging cables over floor and up on positioners. Streamlined connector covers slide over or around obstacles without snagging. If improperly mated, the connector pulls apart before arcing can occur and cause damage.

Durable — Moulded Neoprene covers are not affected by oil, grease, high and low temperatures.

AMPCO METAL, INC.
MILWAUKEE 46, WISCONSIN
West Coast: Burbank, California
Southwest: Garland (Dallas County), Texas

AMPCO

TEAR OUT COUPON AND MAIL TODAY

SEND FOR BULLETIN NOW!

AMPCO METAL, INC.
Dept. 176D, Milwaukee 46, Wis.
Send me bulletin on new Ampco Cable Connector.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

For More Information Circle No. 9 on Reader Service Card. V-184

MEN ON THE MOVE

in the welding industry

Westendarp

Greenberg

APPOINTMENTS:

Edwin (Ed) Westendarp is president of the newly formed American Alloys, Inc., of Newark, California. **Milton Sims,** Los Angeles, is vice president. **Gus H. Emin** is vice president and general sales manager, Chicago. **Barney David,** Los Angeles, is vice president and Western sales manager.

Simon A. Greenberg has been named Director of Engineering and Training Services for Eutectic Welding Alloys Corp., Flushing, N. Y. He had been National Technical Secretary of the American Welding Society for 15 years.

Phillip J. Roberts has joined Stulz-Sickles Co., Elizabeth, N. J. He will be district sales manager for Metropolitan New York, New Jersey and Philadelphia.

Jerry McEvilly has been appointed field representative for the Arcair Company, Lancaster, Ohio. Mr. McEvilly will work out of Milwaukee and cover nine midwestern states.

Lincoln Electric Co. has named **G. N. Bull** manager of a new sales engineering district in Miami, Florida. At the same time Lincoln named three district managers: **Russell S. Hale** (Boston), **E. Larry Smith** (New York City) and **John H. McFeeters,** Albany, N. Y.).

Joseph T. Bullock has joined the sales organization of Fibre-Metal Products Co., Chester, Penna. He will cover the Mid-Atlantic states.

continued on page 20

Circle No. 43 on Reader Service Card. ⟶

P&H TAPE-PROGRAMMING completely automates the fusion process and is far superior to human control. Additional channels on tape and reader provide precise control for rotation, wire-feed, gas and water flow, and other related functions.

P&H MOTORIZED RHEOSTAT permits pre-setting of up-slope, welding cycle, and decay at intervals of 6 to 50 seconds—and controls them at exact values. Weld time can be pre-set or controlled manually.

P&H AUTOMATIC SPOT-GUN CONTROL enables operator to pre-set time interval and heat for starting, welding, finishing, and post-flow of gas and water in spot-gun welding. "Add-on" units for existing welders — integral in new machines.

Now... programmed welding automation from P&H!

with infinitely versatile time-amperage controls.

For example, the new P&H motorized rheostat and sequence timer enable you to weld Space Age and other super-critical metals *automatically!* You just dial the pre-calculated heat-time values and press the start button. The control responds with the exact cycles you need for precisely controlled upslope, welding cycle, and decay. The result: perfectly controlled super-critical welding without thermal shock or cracking.

Another modern development is the new P&H punched-tape control for production welding. This industry "first" enables you to tape your jobs today — and weld tomorrow or next month. You can handle more work and get the same top-quality welds regardless of who operates the unit.

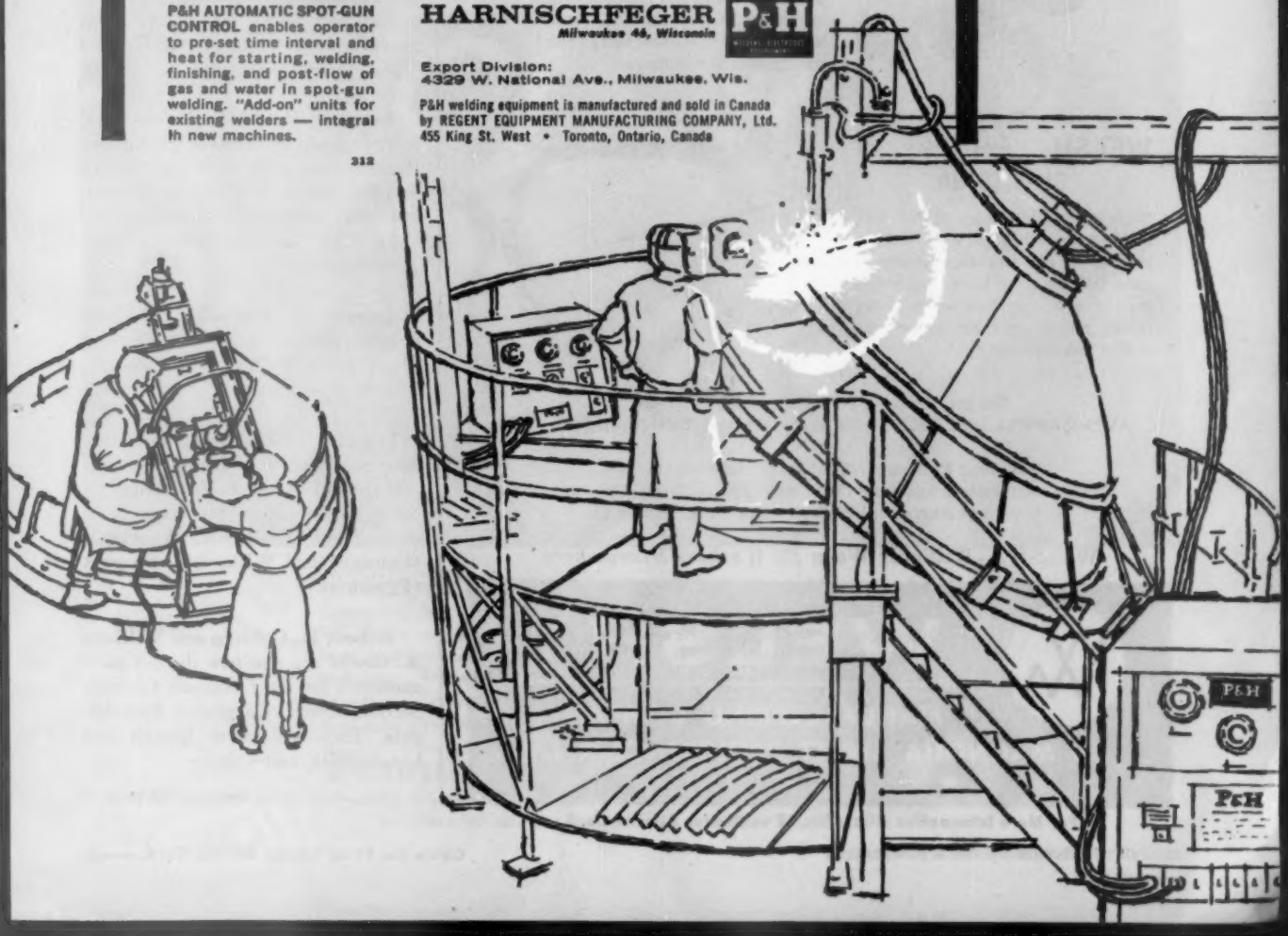
Find out today what P&H time-amperage controls can do for you. Send for Bulletin W-155.

HARNISCHFEGER P&H
Milwaukee 46, Wisconsin

Export Division:
4329 W. National Ave., Milwaukee, Wis.

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY, Ltd.
455 King St. West • Toronto, Ontario, Canada

312



Cushion-Soft Comfort in dependable eye protection

Soft flexible frames provide new wearer appeal in eye protection. Unsurpassed comfort results in increase use of goggles and more working efficiency. Deep cups fit easily over large prescription glasses.

WELSH "Cyclops" ®
Style 5070

A single lens welding goggle with a soft flexible frame provides unusual comfort and fit. Simplified lens holder permits easy changing of filter and cover plates.

WELSH "Soft-I" ®
Style 5054

Welding goggles with a unique soft pliable frame which molds itself comfortably to contours of face and head. Standard 50 mm filter lenses meet every requirement for maximum protection.

WELSH "Zephyr" ®
Style 1070A

Single lens goggle with crystal clear, soft, pliable frame and flanged edge comfortably form-fits your face. Also available in green lens and green frame. Unique lens angle increases immediate working vision. Locking pins on every lens assures easy positive lens assembly.

See the complete WELSH line at BOOTH 408,
AMERICAN WELDING SOCIETY SHOW, Los Angeles, Calif., April 26-28, 1960

West Coast Warehouse: 788 Mission St., San Francisco, Calif.
Southwestern Warehouse: 142 Howell St., Dallas, Texas
Midwestern Warehouse: 1736 South Michigan Ave., Chicago, Ill.

WELSH — *Willingly Worn By Workers Everywhere*

WELSH
MANUFACTURING COMPANY
9 MAGNOLIA STREET, PROVIDENCE, R. I.

For More Information Circle No. 98 on Reader Service Card.

MEN ON THE MOVE

continued from page 18

APPOINTMENTS:

Modern Engineering Co. has appointed two factory sales representatives. They are **Roy Brigance** (Cleveland) and **Vint Gubbins,** (Chicago).

Joe B. Henderson, Jr. is a new application engineer for Wall Colmonoy Corp. He will work out of the firm's Houston, Texas, office as a petroleum industry specialist.

Metal & Thermit Corp., New York City, has announced the appointment of **Peter L. DeDecker** as welding sales engineer. He will cover the West-Central region out of Davenport, Iowa.

Floyd L. Paschke is new sales manager at Rotor Tool Co., Cleveland, a subsidiary of the Cooper-Bessemer Corp.

Alloy Rods Company has appointed two men to its field sales organization. They are **J. A. Fox,** Newark, N. J.) and **R. G. Rogers** (San Francisco Bay area).

Edward P. Mitchell has been named sales engineer on the Eastern Region sales staff of A. O. Smith's Welding Products Division, Milwaukee. Mr. Mitchell will cover New York City and neighboring New Jersey counties.

Joseph M. Dorocke has been named general sales manager at Flood Safety Products Co., Chicago, Illinois.

Two new hard surfacing specialists have been named by **Einar Iverson,** manager of Alloy Rods Company's newly formed Hard Surfacing Division. They are **A. A. Averbeck** (Chicago) and **Willard F. Stewart** (Pittsburgh).

Robert H. Coburn and **William A. Grant** are two new district sales managers for the Electronic Controls Section, Budd Company, Philadelphia. They will cover Detroit and Los Angeles, respectively.

continued on page 22

Circle No. 90 on Reader Service Card. ⟶

Tempilstik°. . . temperature indicating crayons

TEMPILSTIKS° provide a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Tempilstiks° are widely used as a standard method of checking temperatures in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings . . . . . $2.00 each.

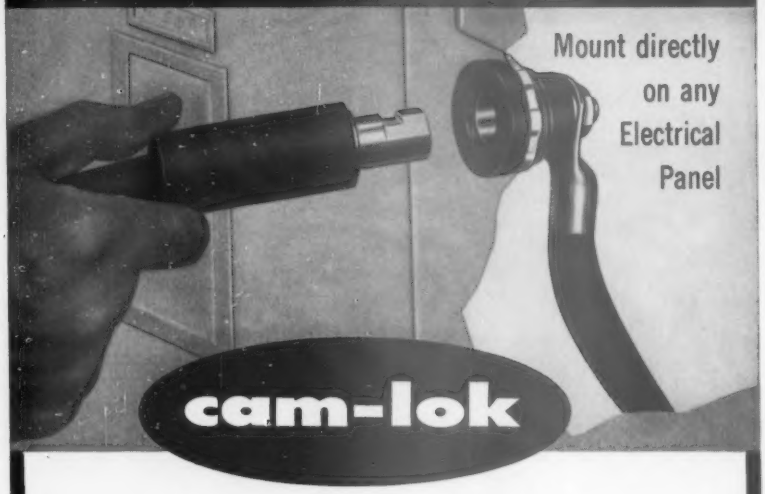
Most leading welding supply houses carry Tempilstiks°. If yours is an exception, then write direct to us for further information.

Tempil° CORPORATION • 132 West 22nd St., New York 11, N. Y.

Visit us at Booth 407—AWS Welding Show—Great Western Exhibit Center, Los Angeles, Cal., April 26-28.

For More Information Circle No. 90 on Reader Service Card.

New Hi-Impact Plastic Insulated Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast direct mounting on . . .

- **ELECTRICAL DISTRIBUTION PANELS**
- **SWITCHGEAR**
- **BUS DUCT**
- **JUNCTION BOXES**
- **WIREWAY or any electrical cubicle**

Visit the Cam-Lok Booth #403 at the Los Angeles Welding Show, April 26-28

cam-lok DIVISION

EMPIRE PRODUCTS, INC.
P.O. BOX U-98
CINCINNATI 36, OHIO

For More Information Circle No. 22 on Reader Service Card.

MEN ON THE MOVE

continued from page 20

PROMOTIONS:

Robert T. Brown is the new manager of Metal & Thermit Corporation's Welding Division. Mr. Brown's responsibilities include research and production of the Murex line of welding machines, electrodes and accessories. He had been sales manager for the division.

Linde Company, Division of Union Carbide Corp., has announced the appointment of **D. W. Morgan** as Manager, Essington Electric Welding Apparatus Factory, Essington, Penna.

Gordon E. Brown has been named sales manager of the West Coast Division of Ampco Metal, Inc., Milwaukee. Brown formerly was Ampco's manager of field sales.

Edwin S. Coyle is new manufacturing manager of the Electronic Controls Section, The Budd Company, Philadelphia.

New vice president and general manager of Norton International, Inc., Norton Company's foreign division, is **Dr. Wilfred F. L. Place.** He succeeds **Frank M. Ryan** who retired earlier this year.

James E. Moore has been named sales and service engineer in the middle-Atlantic states for the Colmonoy Division of Wall Colmonoy Corp., Detroit. He will make his headquarters in Morrisville, Pa.

Harry B. Crutcher is the manager of the newly expanded Automotive Engineering Division of Progressive Welder Sales Co., Detroit.

Standard Steel Corp., Los Angeles, has named Vice President **James E. Cox** as general manager of its Cambridge Division in Lowell, Mass.

continued on page 24

Photo courtesy Caterpillar Tractor Co.

For Speed and Economy in Flame Cutting Using Natural Gas

The use of Harris cutting torches accomplished the most economical balance between cutting speeds and oxygen consumption. Harris torches were selected over competing brands.

This installation permitted performance not otherwise possible and the gas savings are substantial.

For further information call your local Harris Distributor or write to us.

HARRIS

HARRIS CALORIFIC CO.

5501 CASS AVE. • CLEVELAND 2, OHIO

For More Information Circle No. 45 on Reader Service Card.

Ranite Hardsurfacing Rods

give **BEST RESULTS ON EVERY JOB**

YOU CAN

INCREASE PROFITS WITH ECONOMICAL MAINTENANCE

Ranite Rods:

- GIVE DEPENDABLE WEAR.
- FAST DEPOSITION GETS THE JOB DONE QUICKLY.
- EASY TO RUN—A-C or D-C
- NO SLAG TO FIGHT.
- EXCLUSIVE METALLIC COATING PROVIDES MORE DEPOSITED WELD PER POUND.

Ranite
WELDORS' NO. 1 CHOICE FOR HARDSURFACING

FOR COMPLETE INFORMATION SEND THIS COUPON TO:

RANKIN MANUFACTURING CO. P.O. Box 631, Alhambra, Calif.

Name:..... Title.....

Company:.....

Address:.....

State:.....

CHECK HERE

☐ SEND LITERATURE ONLY AT THIS TIME—DON'T CALL.

☐ PLEASE ADVISE WHERE **RANITE** CAN BE PURCHASED.

☐ WE WOULD LIKE TO DISCUSS OUR HARDSURFACING APPLICATIONS WITH YOUR FACTORY WELDING ENGINEER ON HIS NEXT REGULAR TRIP IN OUR AREA.

For More Information Circle No. 76 on Reader Service Card.

MEN ON THE MOVE
continued from page 22

PROMOTIONS:

John Farran has been named Director of Service by Lincoln Electric Co., Cleveland. He succeeds **G. E. Tenney,** retired.

H. B. Jorgensen is the new supervisor of the Sales Training Section at Carborundum Company, Niagara Falls, N. Y.

C. H. Glasier has been appointed executive vice-president of Air Reduction Sales Co., New York.

HOMECOMING:

Donald W. Smith, chief engineer of *Sight Feed Generator Co.,* West Alexandria, Ohio, has returned from an extensive, two month trip to North Africa and Europe. The primary purpose of Mr. Smith's trip was to train personnel of the Caterpillar dealership in Algiers in use of Rexarc automatic welders and positioners. He also made business contacts for his company in Switzerland, Sweden, Germany and France.

ELECTIONS:

R. L. Siebert has been elected president and treasurer of the Milwaukee Electric Tool Corp., Milwaukee. He succeeds his father, **A. F. Siebert,** who died on January 11th.

DEATHS

Richard W. Whitton, 50, west coast sales representative for the Sellstrom Mfg. Co., Palatine, Illinois, passed away suddenly on January 20, 1960. A resident of Huntington Park, Calif., Mr. Whitton is survived by his wife and two sons.

For the Right Touch on the Toughest Welding Job

AO ELKSKIN Gloves

- SOFTER
- HIGHLY FLEXIBLE

Where sensitivity of touch is extremely important . . . on production line welding of high unit cost equipment — American Optical recommends elkskin hand protection. These gloves offer a "kid glove" type of softness for the utmost in flexibility and hand dexterity. By reducing hand fatigue, they pay off with real savings in production costs. What's more, they will provide long service despite high temperatures. Your nearest AO Safety Products Representative can supply you.

NOTE: Welder's eyes are protected by the AO 323A Goggle.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION
SOUTHBRIDGE, MASSACHUSETTS
Safety Service Centers in Principal Cities

Always insist on Trademarked Safety Products

AO 5X311 ELKSKIN GLOVE

- Montpelier pattern
- One-piece back and palm
- All welted seams
- Heavy lining on back
- 14" long

AO 5X363 ELKSKIN GLOVE

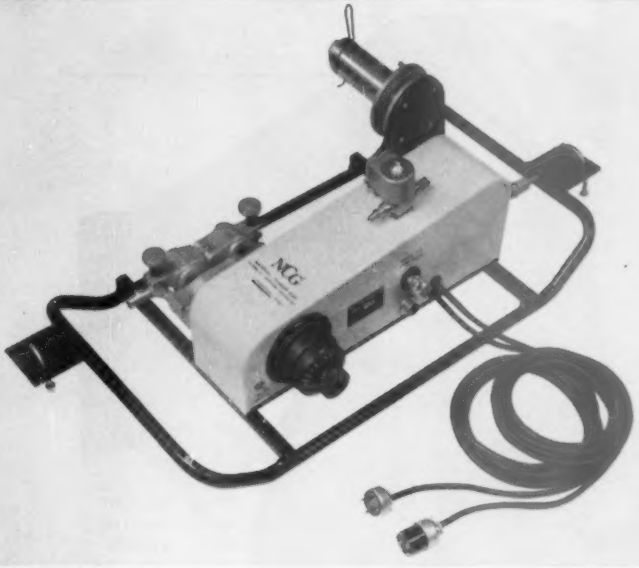
- Gunn pattern
- Two-piece back
- Wing thumb and heavy lining on back
- All welted seams
- 14½" overall length with 7" cuff

Be Safe For Sure . . . With AO SURE-GUARD Gloves

For More Information Circle No. 7 on Reader Service Card.

New NCG® Consumable

Newly designed, incorporating features that were developed to meet field requirements, the new WC-1 Welding Control Unit and the AM-1 Torch have advantages you should know about. Designed for Automanual* consumable electrode welding processes using Argon, Helium or Carbon Dioxide as a shielding gas, they provide maximum versatility and economy.



WC-1 Welding Control with Wire Drive

Double gate wire drive unit—1/10 HP Motor
Wire (3/64" to 3/32") feed rate: 55"—500" per min.
Clears 18" manhole—Weighs 55 lbs.
Easy to control
Sturdy, simple electrical components

AM-1 Torch

Unitized design—molded as one unit
Light weight—hand balanced
Delivers electrode and shielding gas to the arc
Complete package—all cables and hoses supplied
On-off switch on handle
Water-cooled cup

Electrode Welding Equipment

See the DUAL SHIELD welding process in operation during the 1960 AWS WELDING SHOW
April 26, 27 and 28th
Great Western Exhibit Center
Los Angeles, California

BOOTHS 417-418

DUAL SHIELD...

the carbon dioxide welding process that saves

The DUAL SHIELD* process is being used successfully by many plants, and the scope of its application, ranging from plain-carbon to low-alloy high-tensile steels, is constantly increasing. The oxidizing, scavenging and slag-forming flux compounds, the greater amount of weld metal deposited with better penetration, the higher welding speeds, the combination of inexpensive CO_2 and the flux compounds to provide arc stability, and the better weld quality obtained are all factors that contribute to the wide acceptance of DUAL SHIELD welding. Many are realizing good savings in reducing weld time and costs in spot welding and in foundry repair welding.

Four flux-cored electrodes are used with this process:

No. 110—A single-pass electrode for plain-carbon steels with a maximum carbon content of 35 points

No. 111A—A multipass electrode for the same steels welded by No. 110.

No. 150 and 151—Multipass electrodes for high-tensile low-alloy steels.

Since the cost of welding is a major factor in your operations, the DUAL SHIELD welding process and the new NCG WC-1 Welding Control Unit and AM-1 Torch can have an important bearing on your future profits. This new equipment is reasonably priced and the DUAL SHIELD process will cut production costs. It has for others and will for you.

Write today for more information...
Six page bulletin detailing
DUAL SHIELD Welding Process: NH 137.

Circle No. 73 on Reader Service Card.

NATIONAL CYLINDER GAS
DIVISION OF CHEMETRON CORPORATION
840 North Michigan Avenue,
Dept. E-3D, Chicago 11, Illinois

CHEMETRON

NCG offices and authorized DUAL SHIELD *distributors are located in all principal cities.*
Consult the yellow pages for the office nearest you.

© 1960, CHEMETRON CORPORATION

*DUAL SHIELD and AUTOMANUAL are trademarks of CHEMETRON CORPORATION

LEWIS MANIPULATORS and SPECIAL

LEWIS offers precision manipulators for every general-purpose automatic head positioning requirement. Three standard series are available:

BANTAM SERIES — 8′ x 8′ range, 250 lb. rated tip load, portable, free standing pedestal base equipped with wheels and leveling screws.

UNIVERSAL SERIES — 12′ x 12′ range, 350 lb. tip load, portable, available with variety of base mountings, drives and control features.

HEAVY DUTY SERIES — ranges from 12′ x 12′ to 24′ x 24′, tip loads up to 1,000 lbs., available with variety of base mountings, drives, controls, auxiliary equipment, provision for carrying welding power sources, etc.

ALL LEWIS MANIPULATORS FEATURE precision drives, hardened and machined ways and rollers, adjustable rollers for accurate alignment and take-up, maintenance-free design and construction, control of all powered motions by portable pendant operator controls.

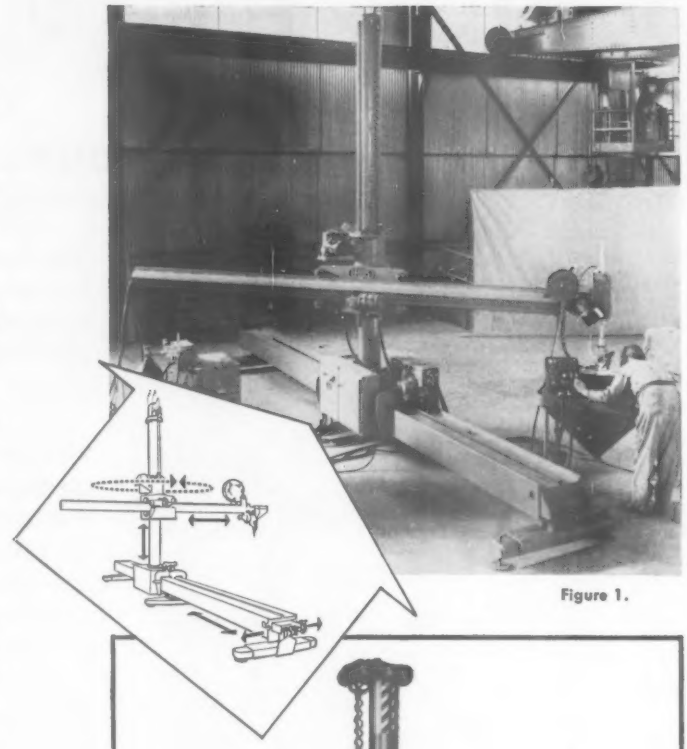


Figure 1.

Figure 1: UNIVERSAL 12x12x18 portable track type manipulator. Precision electronic welding drives on boom and carriage. 30:1 speed range. Rapid traverse at welding speeds. Free standing integral track with exclusive alignment feature. 360° manual boom rotation with positive lock. Constant speed power elevation. Completely portable in one lift by 5-ton crane.

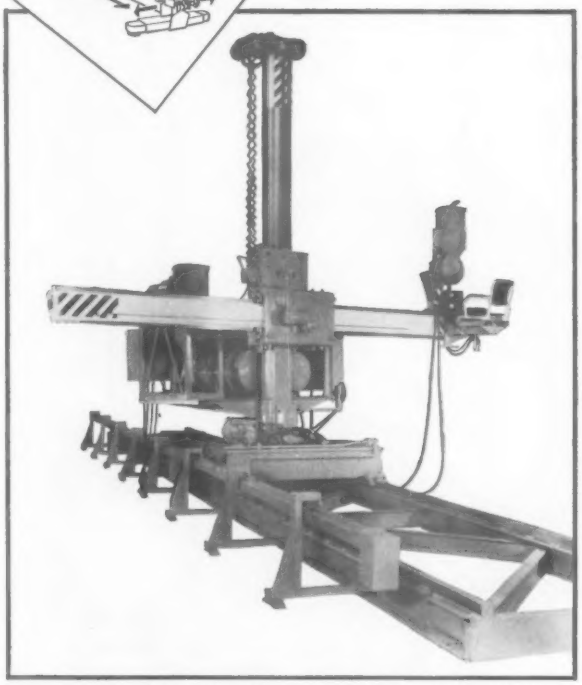


Figure 2. *Photo courtesy Alliance Structural Div., Alliance Machine Co.*

Figure 2: HEAVY DUTY 12x12x35 rail car mounted manipulator. Same precision drives as Universal. Power sources and vacuum unit mounted at column base. Operator chair at boom tip. Power rotation. Track sections equipped with feedrail that delivers primary power to manipulator and welding equipment.

Inquiries concerning your standard or special manipulator requirements are invited. Names of dealers in key industrial areas furnished on request.

See the Universal in operation . . . BOOTH 308
AWS Show April 26, 27, 28
Los Angeles, California

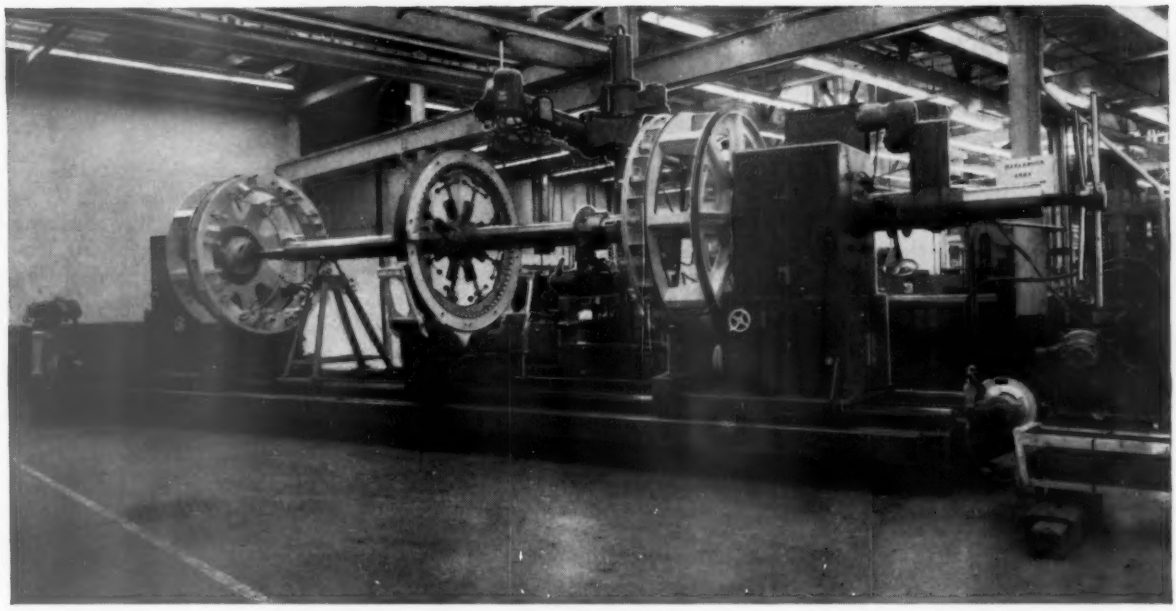
THE LEWIS WELDING & ENGINEERING CORP.
107 NORTHFIELD ROAD • BEDFORD, OHIO

8731-LWE

Designers • Engineers • Fabricators • Machinists

For More Information Circle No. 56 on Reader Service Card.

TOOLING FOR AUTOMATIC WELDING



new tooling concepts facilitate automatic welding of thin-skinned missile structures

Custom engineered tooling "packages" successfully adapt advanced automatic welding techniques to missiles manufacturing.

Even though critical strength-weight ratios in air weapons systems components are being resolved by new lightweight structures and materials, the fabrication of these complex structures still is a problem. Standard tools and production methods are not versatile enough to meet their extreme tolerances.

In automatic arc welding, a basic method of fabricating ultra-thin sections, arc control has evolved to a high level of reliability. But practical application of advanced automatic welding techniques becomes feasible *only through custom tooling.*

The special machine illustrated above is an example of the advanced state of this art. Designed, engineered and built for a specific purpose, it is used to fabricate large-diameter thin-gauge missile fuel tanks from special alloy steels.

For this particular project, massive tooling was required to position, support and rotate fragile preformed tank sections under an automatic welding head. Because of prior finishing, each section had such substantial "added value" that the margin for error was zero.

The specialized tools and fixtures were designed and built to rigid specifications that assured machine tool accuracy.

This type of packaged precision tooling is a specialty with Lewis Welding & Engineering Corp. A production fabricator with more than 20 years' experience, Lewis offers coordinated design, engineering and manufacturing services. This versatile design-and-build capability is based on fully integrated facilities under one quality control responsibility.

If fabricating thin-skinned birds . . . or their components . . . is causing you problems, Lewis has diversified experience in developing tools, fixtures and manipulating equipment for automatic welding processes. Our engineers will be glad to discuss your requirements and to make recommendations.

THE LEWIS WELDING & ENGINEERING CORPORATION

107 Northfield Road • Bedford, Ohio

Designers • Engineers • Fabricators • Machinists

For More Information Circle No. 102 on Reader Service Card.

AWS Welding Show Exhibits $3,000,000

LOS ANGELES: The 41st Annual Convention and Welding Exposition of the American Welding Society to be held here April 25 through 29 will feature a welding show of spectacular proportions—in addition to the regularly scheduled technical and social events. Keeping pace with the rapid growth of the welding industry in recent years, the exhibition of equipment and materials promises to be the largest ever held by the AWS.

Society officals feel that some $3,000,000 worth of equipment will be shown. Many unique examples of modern welded construction will also be on view, including a unitized welded automobile chassis and welder products from industries in and around Los Angeles. Live demonstration of welding processes and equipment will be given; equipment under development at present will be revealed for the first time.

Exhibits will be shown at the Great Western Exhibit Center which has a total area of 70,000 square feet—room enough for a full-size football field and spectator area. Show hours are from 10 am through 10 pm on Tuesday and Wednesday, April 26 and 27, and from 10 am to 6 pm on Thursday, April 28.

IMPORTANCE OF MEETING

Two other facts make this Welding Show and Meeting one of the most important ever held by the Society:

First, this is the first time the American Welding Society has held a Welding Show on the West Coast.

These companies are exhibiting at the A.W.S. April Welding Show . . .

	Booth
A	
Air Reduction Sales Co.	303
All State Welding Alloys Co., Inc.	501
Alloy Rods Company	202
Alphil Spot Welder Corp.	122
Aluminum Company of America	306
American Brazing Alloys Corp.	208
American Pullmax Co., Inc.	805
Arcair Company	800
Arcos Corporation	300, 700
Aronson Machine Company	524
B	
Balteau Electric Corp.	517
Battelle Memorial Institute	601
Bay State Abrasive Prods.	802
Bernard Welding Equipment	518
Birdsell Manufacturing Co.	615
Blackhawk Industrial Div.	302
Bren Weld Corporation	520
E. D. Bullard Company	613
C	
Cam-Lok Division of Empire Products, Inc.	403
Capital Welding & Mfg. Co., Inc.	510
Chicago Tool & Engineering	622
Contour Marker Corp.	519
Cosa Corporation	111
Coyne Cylinder Company	505
D	
Dockson Corporation	104
E	
Elmet Division of North American Philips Co.	514
Emerson Electric Mfg. Co.	620
American Platinum & Silver Div., Engelhard Industries	503
Exomet, Incorporated	611
Eutectic Welding Alloys Corp.	405
F	
R. C. Fessler & Co.	514
Fibre-Metal Products Co.	702
Flood Safety Products Co.	514
G	
General Dynamics Corp. Liquid Carbonic Division	422
Glendale Optical Co., Inc.	433
Gregory Industries, Inc.	310
H	
Handy & Harman	322
Harnischfeger Corporation	317
Harper Trucks, Inc.	512A
Harris Calorific Company	404
Hobart Brothers Company	318
I	
International Nickel Co.	420
J	
Jackson Products, Div. Air Reduction Company, Inc.	321
K	
K-G Equipment Co., Inc.	623
K S M Products, Inc.	406
Kaiser Aluminum & Chemical Sales, Inc.	500
Kedman Company	612
L	
Lenco, Inc.	120
Lewis Welding & Engineering Corp.	308
Lincoln Electric Company	219
Linde Company, Division of Union Carbide Corporation	211
Lummis Manufacturing Co.	514

Worth Of Welding Equipment And Materials

Interest and enthusiasm have been shown by all branches of the welding industry.

Second, April has again been designated as National Welded Products Month to coincide with the Welding Show and Meeting as it was last year. Thousands of the world's foremost welding experts, metallurgists, manufacturers and fabricators who will attend will see emblems similar to the one on the opposite page in exhibit booths and on banners in the exhibit area.

While the Welding Show is scheduled for April 26 through 28, the technical and social events will take place from April 25 through 29. During this week, the Biltmore Hotel in Los Angeles will be the scene of such activities as the presentation of the Adams Lecture by Robert D. Stout, the reading of 69 technical papers, the meeting of various committees and the Society's annual banquet.

An interesting ladies program has been developed and a number of plant tours have been arranged by members of the Los Angeles Section who are acting as hosts.

turn the page for information on the 69 technical papers that will be presented at the AWS meeting

	Booth
M	
McKay Company	103
Magnaflux Corporation	621
Markal Company	608
Marquette Mfg. Co., Inc.	121
Metal & Thermit Corporation	604
Metallizing Co. of America	105
Mid-States Welder Mfg. Co.	413
Miller Electric Mfg. Co., Inc.	311
Milwaukee Electric Tool Corp.	523
Mir-O-Col Alloy Co., Inc.	106
N	
NRC Equipment Corporation	602
National Cylinder Gas, Div. of Chemetron Corporation	417, 418
National Torch Tip Company	410
National Welding Equipment	207
Norris Division Norris-Thermador Corp.	108
North American Aviation, Inc. Missile Division	414
North American Philips Co.	421
O	
Ohio Nut & Bolt Company	110
Omark Industries	607
P	
Page Steel & Wire Division American Chain & Cable Co.	514
Pandjiris Weldment Company	118
Cecil C. Peck Company	618
Philips Electronics, Inc.	301
Phillips Drill Company	315
Picker X-ray Corporation	200
R	
Ragle Industries, Inc.	616
Ransome Company	400, 424
Reid Avery Company	412
Robotron Corporation	504
Robvon Backing Ring Co.	801
S	
Sellstrom Manufacturing Co.	100
Shober, Inc.	614
Sight Feed Generator Co.	113
Simonds Abrasive Company	516
A. O. Smith Corporation	209
Smith Welding Company	102
Sperry Products Company Div. Howe Sound Company	112
Standard Steel Corp.	119
Steffan Manufacturing Corp.	803
C. H. Stevens & Company	403A
Stoody Company	312
Sylvania Electric Products Inc.	617
T	
Tec Torch Company, Inc.	619
Tempil Corporation	407
Thermacote Company	511A
John Tillman & Company	609
Tweco Products, Inc.	512
U	
Uniflex Cable Division Gar Wood Industries, Inc.	107
Unique Equipment Inc.	319
United Wire & Supply Corp.	409
V	
Vacuum Tube Products, Div. Hughes Aircraft Company	610
Victor Equipment Co.	313, 314
W	
Wall Colmonoy Corporation	201
Weldex Division The Metal Craft Company	109
Welding Alloys Mfg. Co.	120A
Welding Design & Fabrication	101
Weldmatic, Division of Unitek Corporation	521
Martin Wells, Inc.	419
Welsh Manufacturing Co.	408
Weltronic Company	114
Westinghouse Electric Corp.	115

69 Technical Papers Highlight Welding Society's 41st Annual Convention

LOS ANGELES: Twenty-three technical sessions are being sponsored at the American Welding Society's 41st annual convention here by the American Welding Society and by the ASME Metals Engineering Division Conference. A total of 69 papers will be presented on the latest developments and research projects in the welding industry.

The five-day program is one of the most comprehensive ever attempted. AWS officials report the quality of papers was never higher.

The technical program is as follows:

APRIL 25

Monday afternoon, three simultaneous sessions on: *Heat Effects on Steel Weldments; Resistance Welding; Structures.*

APRIL 26

Tuesday morning, three simultaneous sessions on: *Fracture Mechanics; Aluminum Alloys; Arc Welding Applications.*

Tuesday afternoon, three simultaneous sessions on: *Fracture Mechanics; Aircraft; Fabrication Procedures.*

APRIL 27

Wednesday morning, three simultaneous sessions on: *Welding and Fabrication of Ni-Cr-Fe Alloys; Rocketry; Weldments.*

Wednesday afternoon, three simultaneous sessions on: *Nonmetallic Structural Materials; Weldability of Steels; Surfacing.*

APRIL 28

Thursday morning, three simultaneous sessions on: *High Alloys; Oxygen Cutting; Gas Shielded Welding.*

Thursday afternoon, two simultaneous sessions on: *Ductility of Steels; Brazing.*

APRIL 29

Friday morning, three simultaneous sessions on: *Columbium, Titanium and Zirconium; Pipe Lines; Processes.*

ADDITIONAL HIGHLIGHTS

Highlights of the week's activities include the annual Adams Lecture on "Higher Strength Steels in Welded Structures" by Robert D. Stout, Lehigh University, on Monday morning, April 25.

Also of interest is a two-part Educational Lecture Series on Monday and Tuesday mornings by H. Schwartzbart of Armour Research Foundation. Clarence E. Jackson, Linde Company, is Chairman and E. E. Goehringer, Lincoln Electric Co., is Co-Chairman.

Visit Welding Design & Fabrication Magazine at Booth No. 101 . . .

Our readers in the Western states are cordially invited to drop in for a visit at Welding Design & Fabrication's Booth No. 101 while they are at the Los Angeles Welding Show. The members of our staff in attendance will be glad for the opportunity of meeting many of these readers for the first time. Our staff will be glad to discuss welding problems, welding articles, and anything pertaining to welding—or even maybe how the Dodgers and the Giants will do in 1960.

And, we'll have plenty of extra, free copies of this April issue with its special report on the high-strength steels. Issues of this kind are always in great demand. If you want an extra copy, this is your chance.

And, during your visit we'll show you the 1960/61 edition of our Welding Data Book. This "bible of the industry" contains more than 356 pages of information on techniques and processes for welding and fabricating almost all metals. It also includes a listing of 350 different welding products and who makes them, a listing of 2000 trade names, condensed product specifications, and a listing of 2000 independent welding supply distributors and manufacturers' sales outlets.

EMERSON ELECTRIC

NEW *PORTABLE*

180c

...HIGH CAPACITY PERFORMANCE!
...LIGHTWEIGHT FOR EASY PORTABILITY!
...LOW, LOW PRICE!

The Emerson Electric Portable 180c... cuts, brazes, solders, welds... can be used with twin carbon torch. One man can carry this compact, 68 lb. unit wherever it's needed. The Emerson Electric Portable 180c delivers maximum amperage for any of the 6 most commonly used welding heats. Uses most types of 3/32" to 5/16" AC rods. Dependable Emerson Electric 8" four-bladed fan provides effective cooling. Get the Emerson Electric Portable 180c – at a new low, low price.

A COMPLETE LINE FOR MOST WELDING NEEDS

90 AMP	180 AMP	205 AMP	295 AMP	200 AMP DC
Light Duty	Medium Duty	PORTABLE	Heavy Duty	Gas Engine Driven

See your local Emerson Electric Welder Distributor or Write Dept. W-538 for Specifications and Prices!

EMERSON ELECTRIC *of St. Louis*

8100 FLORISSANT • ST. LOUIS 36, MO.

For More Information Circle No. 30 on Reader Service Card.

PROGRESS IS NEVER A

To the Welding Industry...

EUTECTIC RESEARCH MAKES THE BIG DIFFERENCE

IN OUR 20th YEAR OF

World Headquarters
Flushing, New York

MATTER OF CHANCE

Real progress doesn't "just happen". It must be carefully and deliberately *created!* It requires dedication and a relentless desire to make things better than they are.

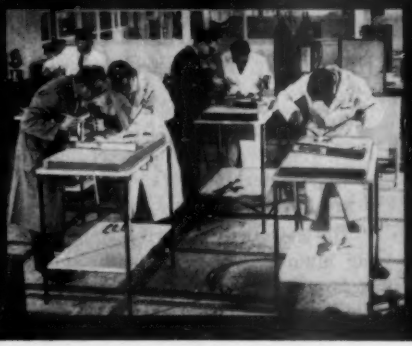
Ceaseless research has been the key to EUTECTIC progress since its inception 20 years ago. It began with the discovery of the "Surface Alloying" principle and the development of the exclusive Low Heat Input Welding Process – and has continued through the development of the more than 160 EUTECTIC "Low Temperature Welding Alloys"®, Fluxes and Welding Aids. The purpose has always been the same: to develop better methods of providing faster, easier and stronger welds... *while minimizing stresses, embrittlement, distortion and warpage created by conventional high heat methods.*

Today, these efforts are still going on – more than ever before! Every year finds new plants... new laboratories... new equipment being added to our already extensive facilities throughout the world. Soon, a vast new Foundry and Metallurgical Center will be completed – heralding the start of the most ambitious research and development program ever undertaken by this or any other company in the field.

Progress, based on research, is the primary aim at EUTECTIC. And progress *to us* means better products, improved techniques, and greater service *for you.*

NEW FOUNDRY AND METALLURGICAL DIVISION being constructed will house complete facilities for metallurgical research and developments, as well as the actual production of core wires from virgin metal.

PROGRESS AND SERVICE



VISIT OUR BOOTH 118
APRIL 26-27-28 '60
GREAT WESTERN EXHIBIT CENTER
Los Angeles, Calif.

WELDING SHOW

Sponsor:
AMERICAN WELDING SOCIETY, INC.
APRIL-NATIONAL
WELDED PRODUCTS MONTH

® REGISTERED TRADE MARK OF :

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40-40 172nd St., FLUSHING 58, NEW YORK

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CANADIAN PLANT AND HEADQUARTERS: MONTREAL
WAREHOUSES: DARTMOUTH, N. S., TORONTO AND VANCOUVER

For More Information Circle No. 32 on Reader Service Card.

Eutectic Establishes European Research Center

FLUSHING, NEW YORK: Eutectic Welding Alloys Corp. and its European affiliates have started a huge research and development center in Lausanne, Switzerland, according to Rene D. Wasserman, Eutectic's president and director of research. Mr. Wasserman has just returned from an inspection tour of his affiliated European countries. Research work has already begun in temporary quarters, pending completion of specially designed and engineered facilities later this year.

Mr. Wasserman also revealed a closely coordinated program for the exchange of information between European researchers and Eutectic in the United States.

Film On Selection Of Arc Welding Electrodes

TROY, OHIO: "Arc Welding Electrode Selection" is the title of a 25-minute 16mm full color film just produced by Hobart Brothers Co. The film explains the basic factors which are important in selecting the correct electrode for a particular application.

Reservations for a showing of the new film may be made with Hobart's Film Library in Troy, Ohio.

30 Attend Lincoln's 39th Design Seminar

CLEVELAND, OHIO: The Lincoln Electric Co. has sponsored 39 design seminars during the last four years. Over 750 men have attended them. The 39th seminar just completed was attended by 30 engineers from the United States and Canada.

Two types of seminars, one for structures and the other for machinery, are arranged to show what welded design can do in improving performance and reducing costs. The material presented combines practical experience with theory to develop a cost reduction approach to fabrication and the efficient use of materials through welded design.

COMING EVENTS

April 25-29: Annual Meeting and Welding Exposition, American Welding Society, Los Angeles.

May 5-7: Annual Convention, National Welding Supply Association, Palmer House Hotel, Chicago.

May 9-10: Annual Convention, International Acetylene Association, San Francisco.

May 9-13: 2nd Southwestern Metal Congress and Exposition, American Society for Metals, Dallas, Texas.

May 23-26: Design Engineering Conference, Machine Design Division of ASME, New York City's Coliseum.

October 13-15: Western Welding Technical Conference and Welding Show, Santa Clara Valley Section, AWS, San Jose, Calif.

October 17-21: 42nd Annual National Metal Show, American Society for Metals, Philadelphia.

NWSA Meets In Chicago

PHILADELPHIA: H. B. "Doc" Sharer, United States Rubber Co., is making a return appearance at a National Welding Supply Association. He will keynote the Association's 16th annual convention at the Palmer House in Chicago on May 5-7.

The Association's annual Contact Booth Program will be held on Friday afternoon, May 6th.

EDITOR'S NOTE: Complete details about the Convention will appear in our May issue.

American Alloys Produces Automatic Wire

NEWARK, CALIF.: A new name in the automatic welding electrode wire field was introduced here last month. It is "Amerloy", trade of newly formed American Alloys, Inc.

The new firm is currently producing aluminum in cut length, spools, coils, rims and coated electrodes; titanium, magnesium and stainless in cut lengths and spools, and copper-based alloys in spools. It is also set up to reprocess, clean and respool all alloys in all diameters.

The firm is installed in a new concrete and steel plant covering ½ acres. Equipment includes automatic spooling and coiling equipment, as well as cutting machines.

more news on page 91

About NWSA

BY A. C. AXTELL

president
National
Welding Supply
Association

As President of the National Welding Supply Association, I have been privileged to meet with several hundred welding distributors from all over the U.S.A. In general many phases of our businesses are the same regardless of the area. Inventory, financing, office procedures, salesmen, incentive system, faster and better service are only a few of the subjects that are usually discussed. To most of these subjects the answers for doing better emerge after some discussion. However, one subject that continually makes itself present is how to get the user of Welding Equipment to recognize that he gets more by buying from and thru his local welding distributor.

In recent weeks I have had a number of open and frank discussions with users of welding equipment on just why they prefer to buy directly from the manufacturers rather than the distributor, also a number of those that prefer to buy only from the distributor rather than the manufacturer. Those that would prefer to buy from the distributor cite many of the same reasons as will be listed later, since they are on our side they are not the distributors' immediate problem.

Some of the reasons given for wanting to buy from the manufacturer:

Some users feel: the manufacturers sales representatives

continued on page 120

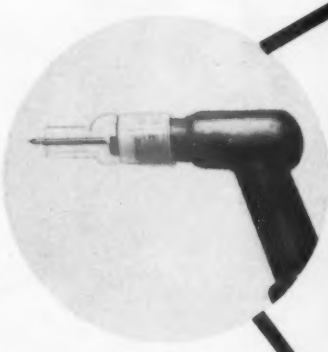
TEC PRESENTS AN UNBEATABLE FORMULA FOR TOP TIG WELDING!

TEC Visuweld Watercooled Torch

The standard bearer of the quality TEC Torch line proven by scores of satisfied users throughout the country.

Lightweight, and maneuverable, the TEC water-cooled operates from 3 to 350 Amps with maintenance free efficiency because of one-piece torch head design which eliminates troublesome wearing or leaking.

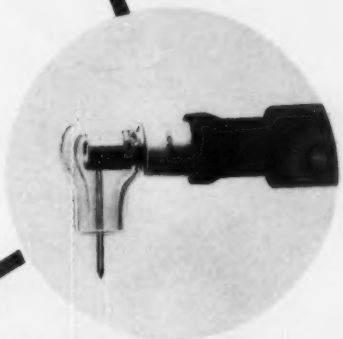
Exclusive "tip-of-torch" water cooling affords continuous welding even at 350 Amps. No finer welding instrument on the market.



TEC Air-cooled Torch

This smooth operating newcomer to the TEC line is gaining plaudits for its great gas savings and its effortless performance.

Rugged and durable due to one piece construction of phenolic plastic reinforced with macerated fiber glass, the TEC Air-Cooled utilizes both standard and off-set Visuweld transparent nozzles.



TEC Spot Gun

Here's the one spot gun that has been engineered not to create problems, but to solve the production gap between resistant welding and arc welding.

Lightweight, "tip-of-torch" cooled, and trouble-free the TEC Spot Gun enables welding all gauge thickness joints from only one side efficiently and economically.

TEC "Tiny Giant" (Pencil) Torch with Off-set Nozzle)

Only the magic of TEC ingenuity could have developed so simple, yet revolutionary an innovation.

TEC's off-set nozzles and chucks convert the TEC watercooled and air-cooled torches into miniature torches which enable TEC TIG welding in less than 1½ inches of space!

You always have the winning formula when you specify TEC for your TIG welding requirements. Dedicated to producing the finest possible equipment in the industry, TEC products have proven time and time again that they out-perform all others . . . that tig welding can be more economical, maintenance free, and can produce results never before achieved. See your nearest TEC distributor today or contact TEC directly for personal service.

BOOTH #619 APRIL 26-27-28
GREAT WESTERN EXHIBIT CENTER Los Angeles, Calif.
WELDING SHOW
Sponsor: AMERICAN WELDING SOCIETY, INC.
APRIL-NATIONAL WELDED PRODUCTS MONTH

Vycor is a registered trade name of Corning Glass Works, Inc.

TEC TORCH COMPANY, INC., CARLSTADT, N. J. Manufacturers of Visuweld Equipment

For More Information Circle No. 89 on Reader Service Card.

He cut **both** grinding **and** finishing time

Ten years experience in aircraft maintenance and actual screw machine operation gave Alden U. Maynard a knowledge of metals and metal-working techniques that was uniquely useful to him when he joined Abrasives & Tools, Inc., Auburn, Mass., fifteen years ago. Since then, his experience has included virtually every type of grinding operation in the metal-working industries.

for Sims Cab Company

Sims V. P. Ralph Johanson & Operator Jack MacDonald examine finish on tractor-cab weld seams after grinding with Bay State's Blue Flash Disc-Wheel.

The perfect grinding wheel for the J. Frank Sims Cab Company of Rutland, Mass. would be both a lion and lamb; it would cut fast and grind smooth enough for painting. And in their constant effort to reach perfection, they've tried just about every wheel that's made.

The sheet metal cabs and other products they fabricate for the major tractor companies come out of the welding shop with a good many yards of welded seams that have to be ground down to a flat surface. The roughing operation must be fast and at the same time must leave a fairly good finish, thereby minimizing the time required for the final, more expensive surface-blending operation.

When Alden Maynard (of Bay State distributor Abrasives & Tools, Inc.,) first introduced Bay State's standard Blue Flash Raised Hub Disc Wheel at Sims Cab, it came closer to the ideal combination of speed with smooth finish than any competitive wheel . . . and it has maintained that superiority ever since. As Sims V. P. Ralph Johanson says: "We go by simple arithmetic. A wheel that cuts both grinding time *and* finishing time is going to cut costs, too . . . and every nickel we cut out of costs helps build us a profit. That's why the Blue Flash is our standard wheel."

Like Alden Maynard, your own Bay State distributor or direct representative is a trained abrasive specialist. His own experience is backed by one of the finest research and development facilities in the industry at Bay State's Westboro headquarters. So, whether your requirements call for a standard wheel or a special formulation, you can be sure of intelligent analysis and *practical* results from Bay State because . . . *better grinding at lower cost, that is our business.*

Operator Jack MacDonald grinds weld beads off rounded corner of tractor cab at Sims Cab Co., using Bay State's standard Blue Flash Raised Hub Disc Wheel.

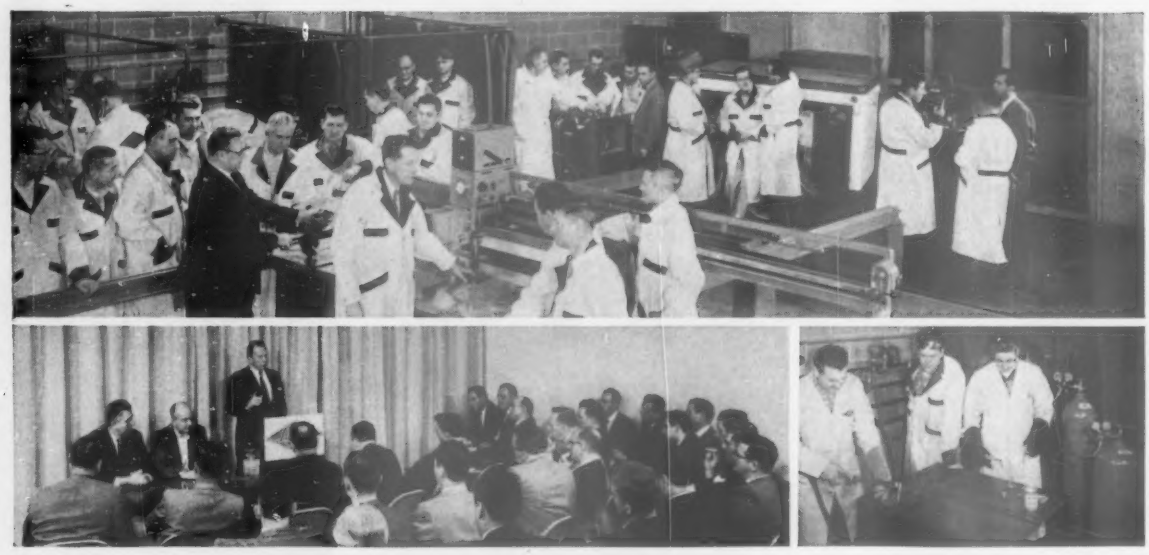
BAY STATE ABRASIVES

BAY STATE
WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

For More Information Circle No. 17 on Reader Service Card.

What new ways can you save with industrial gases ?



ask your Liquid Carbonic sales engineer...

Visit booth no. 605, AWS Welding Show

So many are the ways to use compressed gases . . . so rapidly do new techniques appear . . . how can you keep up with them all?

That's our job—a part of Liquid Carbonic service.

Through a continuing program of "What's New" seminars, Liquid Carbonic sales engineers learn all the recent developments at first hand: new applications of gaseous and liquid oxygen, liquid nitrogen, hydrogen, acetylene, CO_2, argon. Cost-cutting ideas for steelmaking, casting, cutting, fabricating, welding . . . all learned from the practical standpoint—all "learned by doing."

Discover the latest applications of industrial gases, using dynamic Liquidweld apparatus and precision Messer cutting machines.

GD GENERAL DYNAMICS CORPORATION | LC LIQUID CARBONIC DIVISION

GENERAL DYNAMICS CORPORATION / Liquid Carbonic Division
Dept. WDF, 135 South LaSalle Street, Chicago 3, Illinois
In Canada: Liquid Carbonic Canadian Corporation, Ltd., Montreal 9, Quebec
A MAJOR PRODUCER OF COMPRESSED GASES: OXYGEN, ACETYLENE, NITROGEN, HYDROGEN, ARGON, CARBON DIOXIDE, NITROUS OXIDE, HELIUM AND VARIOUS GAS MIXTURES

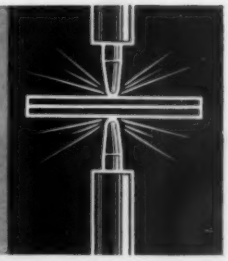
For More Information Circle No. 62 on Reader Service Card.

P R MALLORY & CO Inc

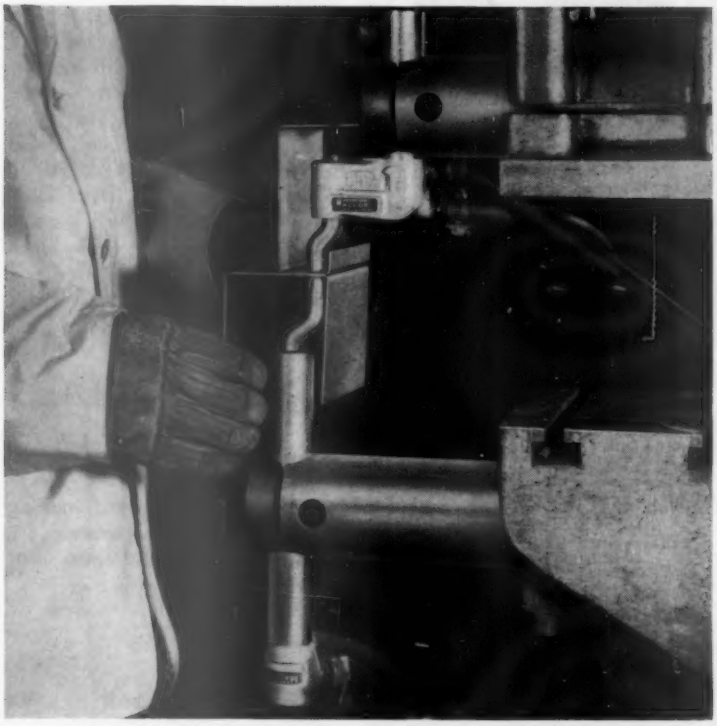
MALLORY MEMOS

NEWS AND TIPS ON RESISTANCE WELDING

Mallory Metallurgical Company, Indianapolis 6, Indiana



MALLORY standard components make "special" set-ups simple



The tricky-looking resistance welding set-up shown here can be put together in minutes . . . at low cost . . . from standard Mallory holders and electrodes that you can get from any Mallory distributor's stock. The upper holder is a 500 Series Heavy Duty offset ejector type. On the lower welder arm is a 300 Series "Premium" Heavy Duty water cooled ejector type holder. Both upper and lower electrodes are standard Mallory 3 double bend electrodes with pointed nose. Another "special" job solved with standard Mallory parts!

Whether your welding work calls for straightforward or unusual configurations, it will pay you to check the thousands of combinations possible with standard Mallory holders and electrodes. Over 200 different electrodes include straight, single and double bend, offset, swivel and irregular shapes in many nose contours and alloys. Holders are straight, universal, paddle type, heavy duty and low inertia types.

For prompt service on Mallory electrodes, holders, seam welding wheels, castings and forgings, call the nearest of the distributors listed on this page.

Mallory Resistance Welding Products are available from these Authorized Distributors:

Atlanta, Ga.
Pye-Barker Welding Supply Co.
Lee S. Wolfe & Co.
Bell, Calif.
A. P. Seedorff & Co.
Binghamton, N. Y.
Welders Supply Co.
Birmingham, Ala.
Alloy Rods & Abrasives Co.
Hinkle Supply Co.
Brooklyn, N. Y.
Collins & Co.
Buffalo, N. Y.
Mills Welding Supply
Cambridge, Mass.
Austin-Hastings Co.
Charlotte, N. C.
National Welders Supply Co.
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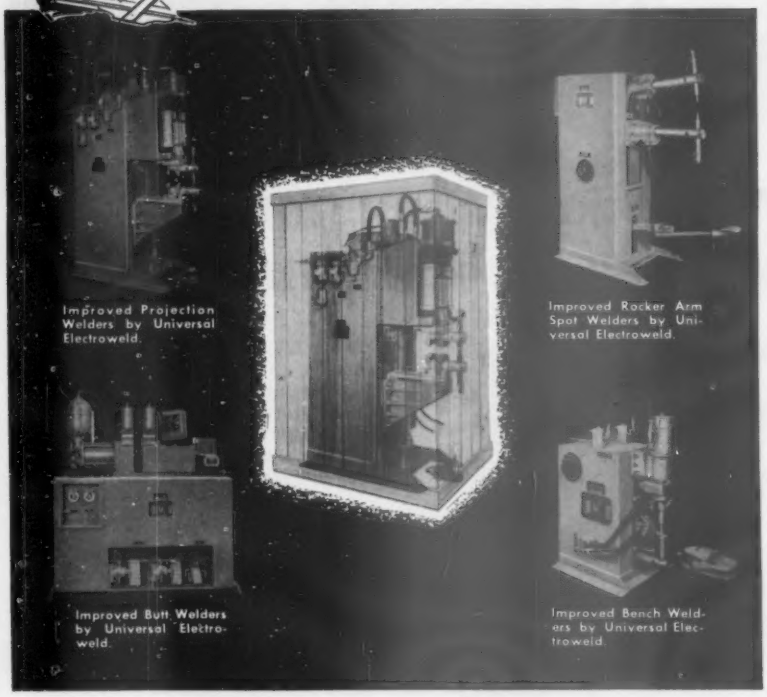
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LIBRARY

of welding

Welding Symbols

American Standard Graphical Symbols for Welding (Y32.3-1959); American Standards Association, 70 East 45th Street, New York 17, New York, or from American Society of Mechanical Engineers, 29 West 39th Street, New York 18, New York; 100 pages; $3.00.

The latest revision of the American Standard Graphical Symbols for Welding has been approved by the American Standards Association and published by the American Society of Mechanical Engineers.

Designated Y32.2-1959, the new American Standard provides the means of placing complete welding information on drawings. The standard, which was formerly designated American Standard Z32.2.1-1949, eliminates the confusing terms "near side" and "far side," which become meaningless when joints are shown in section. In the system introduced in the revision, the joint becomes the basis of reference. The terms substituted are "arrow side," referring to the side of which the arrow of the graphical symbol appears, and "other side."

The 100-page booklet includes the American Welding Society's quick-reference chart of standard welding symbols. Detailed instructions are given for graphical representation of every kind of weld.

Welding Data Book

Industrial Publishing Corp., 812 Huron Road, Cleveland 15, Ohio; 900 pages; $10.00.

The second issue of *The Welding Data Book* (1960-1961 edition) has been published by the Industrial Publishing Corp. Compiled and edited by the editors of WELDING DESIGN & FABRICATION and WELDING ILLUSTRATED, the 900-page Data Book lists the manufacturers of more than 350 products, describes close to 2,000 trade names and lists more than 2,000 local welding sales outlets. It also has 356 pages of technical and engineering data and contains more than 200 pages of manufacturers' catalogs and advertisements.

continued on page 44

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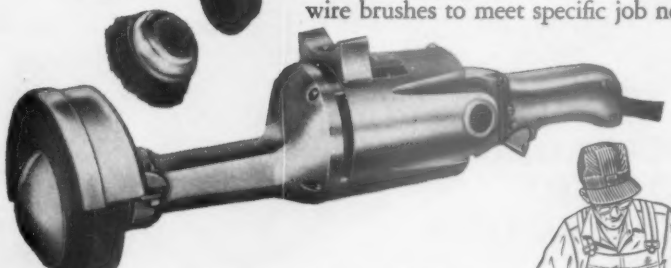

AERIAL GRINDERS. 3 models . . . 4", 5" and 6" wheel diameters . . . 4000 to 5550 RPM. For preparation of surfaces for welding, to smooth off welds, snag and grind castings, remove rust, scale and old paint, and general cleaning and buffing.

For a convincing demonstration, see them at our booth No. 523, AWS, 1960 Welding Show —Los Angeles, Calif., April 26-28, 1960 or at your nearby Milwaukee Distributor, or write

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continued from page 42

ASTM Copper Standards

1959 Compilation of ASTM Standards on Copper and Copper Alloys, B-5, 720 pages, hard cover, 6 by 9-inches; American Society for Testing Materials; $7.50.

This compilation contains 137 standards. Of these, 17 are new, revised or have had their status changed since the previous 1957 edition. In addition to standards for cast and wrought copper and copper alloys, the book contains some material on non-ferrous materials for electrical conductors, certain selected specifications on non-ferrous metals and alloys for primary forms of copper, zinc, lead and nickel used in copper-alloy products.

The standards include test methods, definitions, specifications, classifications, and recommended practices. These are applicable to copper and copper alloys, filler material, pipe, tubes, wire, rod, bar, shapes, die forgings, plate, sheet strip and rolled bar. Copper-alloy ingots and castings are also covered.

Welding T-1 Steel

"Development of Notch-Ductile Stress-Relieved Weld Metal for the Fabrication of Dynamically-Loaded T-1 Steel Structures" by J. S. Kobler, Naval Gun Factory; April, 1959; 64 pages. Order PB 151990 from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.; $1.75.

The Navy developed a new weld metal to solve a problem in making light gage, high-yield-strength structural steel weldments that withstand dynamic loading at low operating temperatures.

When available electrodes were used in the fabrication of a shipboard missile launching system, a notch-sensitive fusion-zone occurred in stress-relieved T-1 steel welds. Electrodes developed as a substitute by the Navy deposit compatible stress-relieved weld metal yielding uniform energy absorption values, equivalent to those of the base metal, through all zones across the T-1 weld joint.

A proposed military specification for the electrodes is included in the report.

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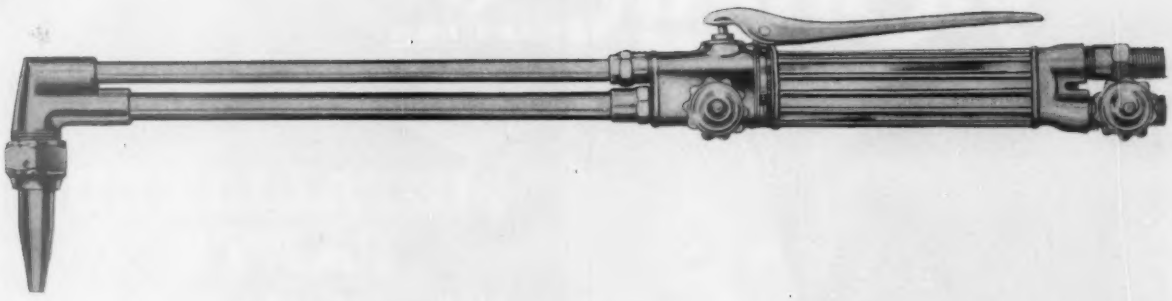


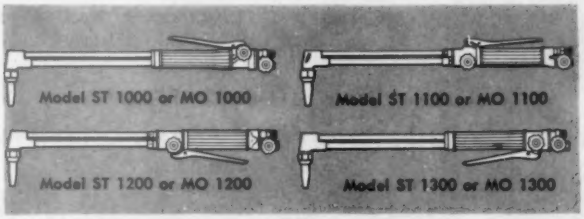
In the Victor line you'll find all the features you want! You have a choice of preheat gases, heads, lever positions, lengths, wide operating range.

FOR ACETYLENE: Model ST and MO series hand-cutting torches.

OTHER FUEL GASES: The new Model STN series hand-cutting torches with improved injector type gas mixers operate on either low (2-6 oz.) or medium pressure natural or propane type gases. This design has been thoroughly field tested and proven for maximum performance and efficiency.

HEADS: You can have either Everdur bronze (ST) or Monel (MO) head, angled at 90°, 75°, 180° . . . or 45° (ST models only).

OXYGEN LEVER POSITIONS: Four, as shown.



LENGTHS: 21", 27", 3' and 4'. (Special lengths on request).

OPERATING RANGES: Standard ST and MO models cut to approximately 8", using acetylene tips to size 5. Heavy duty (HD) models are available for work requiring tips above size 5, for gouging, scarfing, scrap cutting, etc. The new STN series use natural or propane type tips to size 8.

Remember, you can get Victor cutting attachments and machine cutting torches for use with acetylene—also for use with low or medium pressure natural or propane type gases. For the finest choice in cutting equipment, call on your Victor dealer now.

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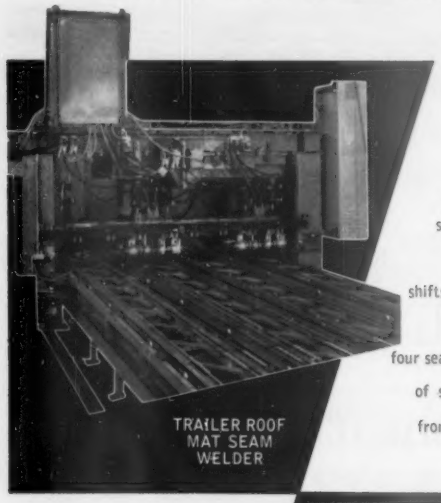


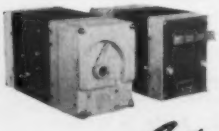
TRAILER ROOF MAT SEAM WELDER

Welds four seams in one direction, shifts, and welds remaining four seams. Length of seam varies from 21 to 45'.

STAINLESS STEEL ROOF MAT TO CROSS MEMBER WELDER

Machine feeds, shears, and welds strip stock to roof stock and cross-member stock up to 855 times on 45' long roof assembly.

Total time is 18 minutes



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Standard fixture and Gun-Type resistance welding transformers from 10 to 500 KVA ratings; or to your specifications. 30,000 now in operation.

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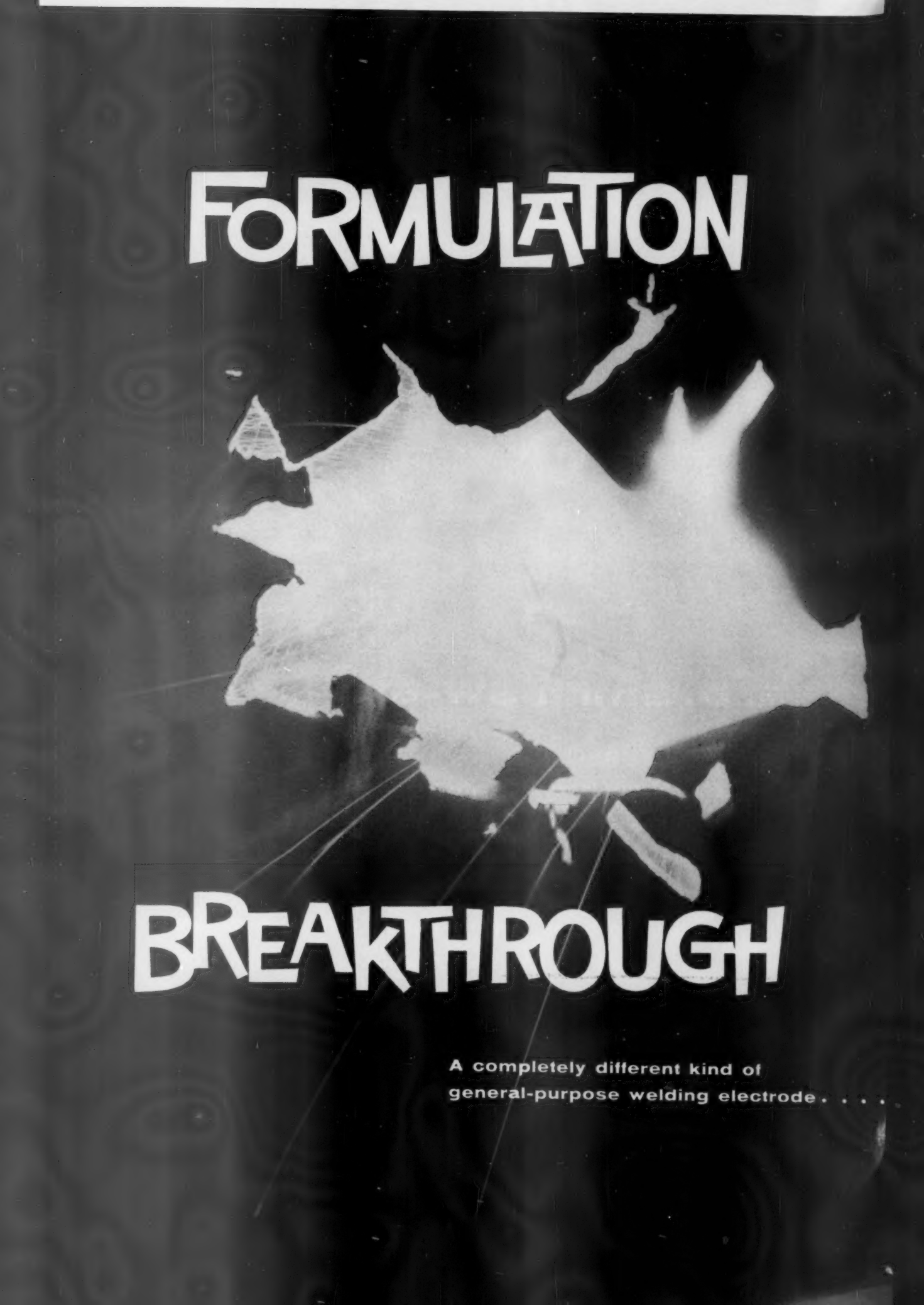
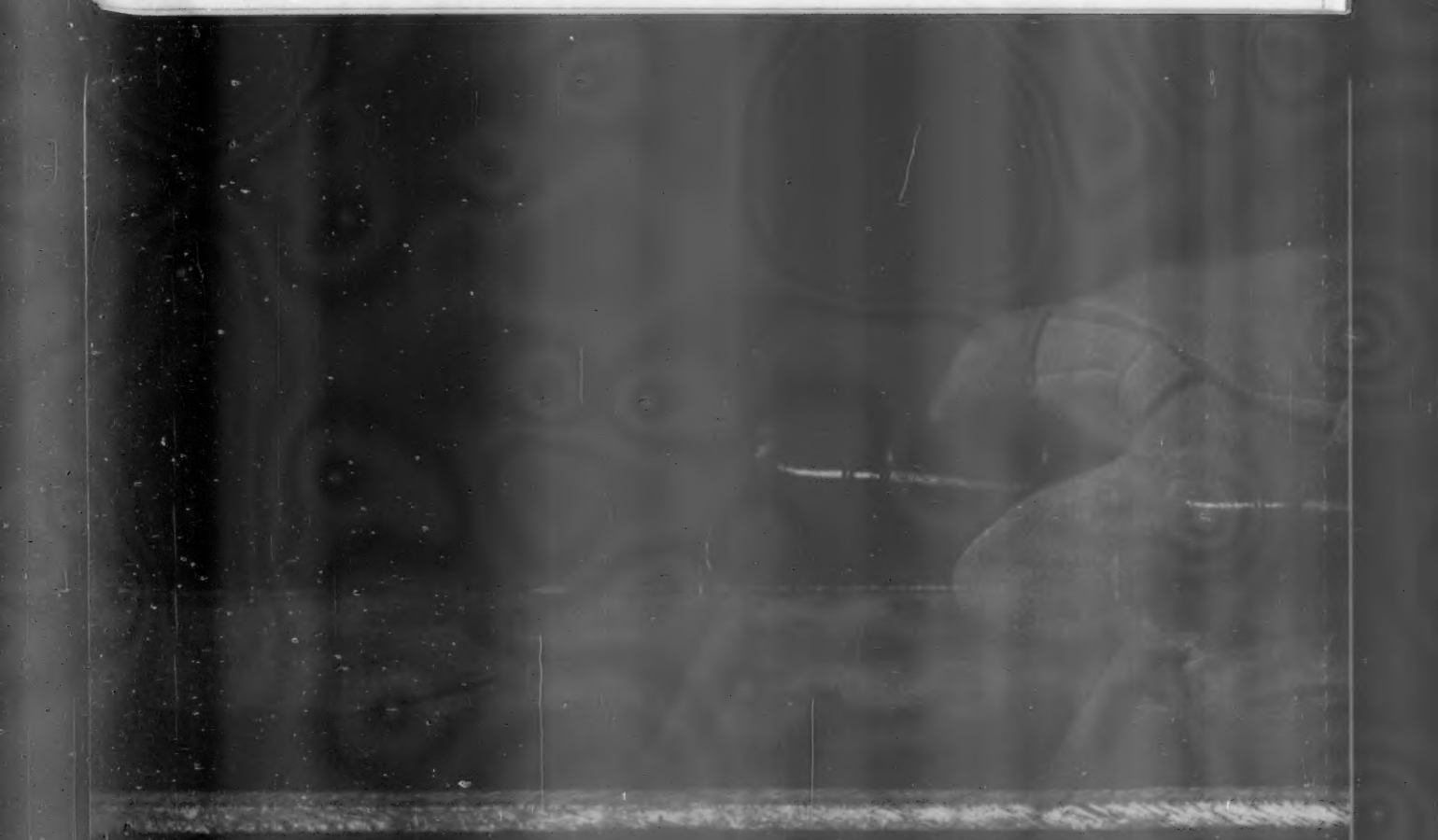
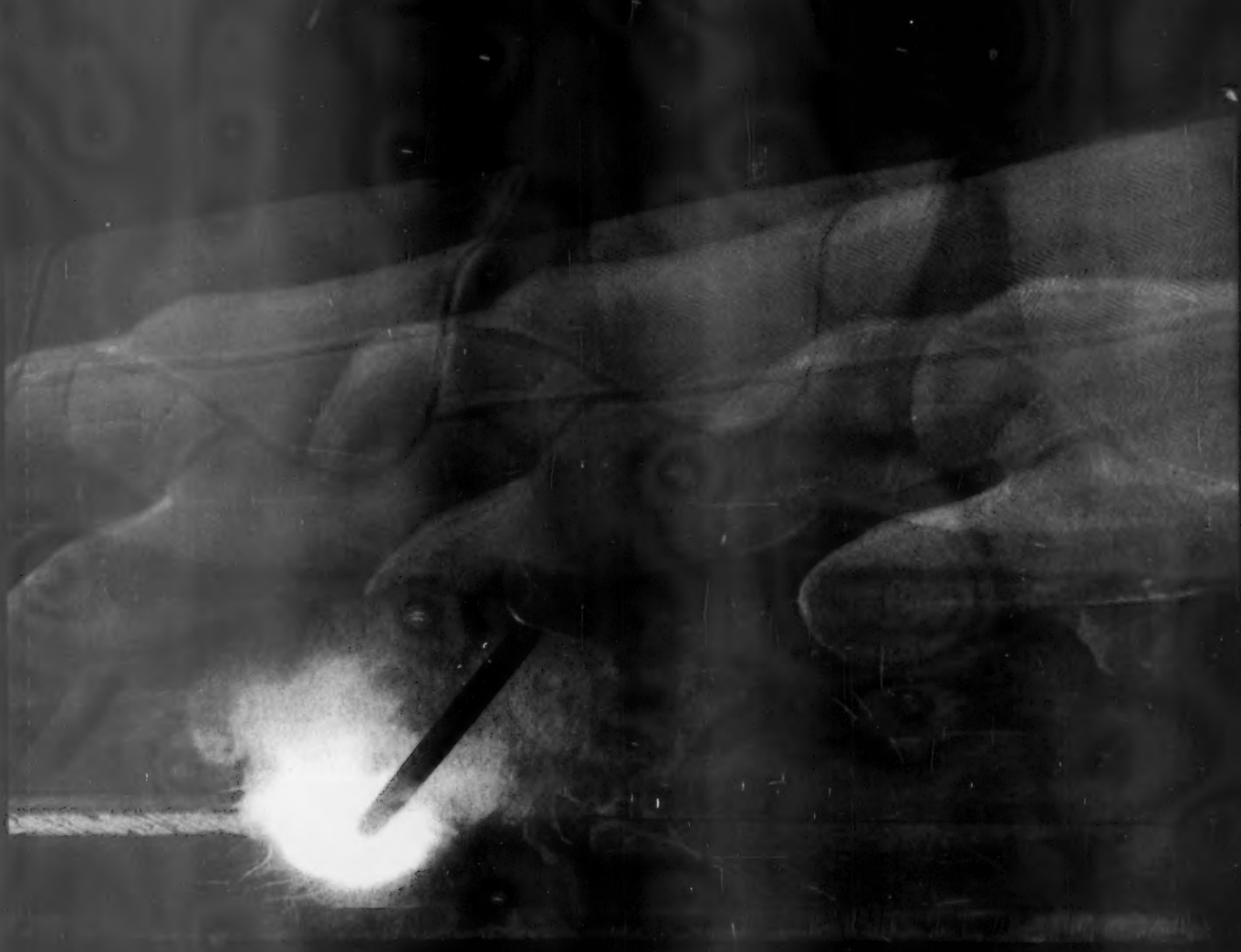

FORMULATION
BREAKTHROUGH
A completely different kind of
general-purpose welding electrode. . . .



A. O. Smith SW-612 – hottest news

Another welding milestone by A. O. Smith! It's the completely new and different SW-612 – a mild steel rod that handles like an E-6013 with the characteristics of a Class E-6012 electrode. Our engineers aptly describe it as a "formulation breakthrough" – a clean break with the past – completely different in appearance and performance. A beautiful bead with virtually no spatter, reducing slag removal and

MADE BY WELDERS FOR WELDERS . . . .



in welding since we invented the electrode*

cleaning time at least 50%! Versatile enough to replace several rods in its class, thus simplifying selection and storage problems. Send for a free test sample of this revolutionary electrode today and see it demonstrated at The American Welding Society Exposition in Los Angeles, April 26-28.

*A. O. Smith introduced the first paper-wrapped electrode way back in 1919.

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on display for your inspection
April 26th - 27th - 28th
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11-13½% MANGANESE-NICKEL-STEEL
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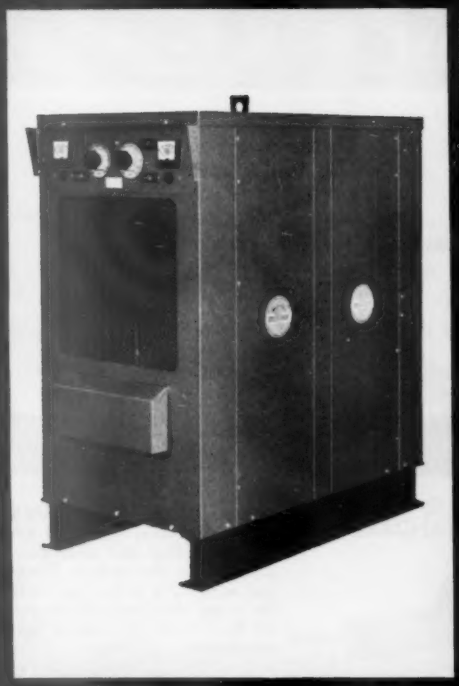
Get the lion's share of meaty facts out of this issue of WELDING DESIGN & FABRICATION before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.



Model SR-1000-A1

TWO NEW ONES YOU SHOULD KNOW ABOUT

miller WELDERS

Model SR-1000 is a three-phase transformer with exclusive Miller-made completely sealed semi-metallic rectifiers. It delivers 1000 amperes of d-c at 40v on 100% duty cycle.

As a power source, the SR-1000 has won wide acceptance for Arcair processes, TIG or MIG cutting, automatic welding, submerged arc, plasma jet, melting, electric furnaces, stress relieving, and other demanding, high temperature applications.

A single range output control with continuously variable rheostat may be replaced with optional remote control. Parallel or series hookups are provided for with multiple output controls available.

Advantages of the Miller SR-1000 include minimum maintenance, quiet operation, low idling input, low starting currents and marked economy.

DD-250-L Traditional Miller welder/power plant efficiency is retained in the new DD-250-L d-c welder and a-c power plant to which has been added diesel economy and safety.

Hercules 38 h.p. 3 cylinder direct injection diesel engine drives new Miller DD-250-L d-c welder/a-c power plant, which delivers:

- Two d-c welding ranges: 50-200 amperes, 150-350 amperes
- Duty Cycle: 100%
- Rated output: 250 amperes d-c at 40v, 100% duty cycle
- Maximum open circuit voltage: 65
- Current adjustment steps: infinite
- Power: 12 KW, 115-230v single phase, 60 cycle a-c. Up to 6.5 KW a-c while welding. 1 KW, 115v auxiliary d-c power while welding.

Model DD-250-L

Complete specifications on either or both of these items will be sent promptly upon request.

miller ELECTRIC MANUFACTURING COMPANY, INC. APPLETON, WISCONSIN

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*says Ben Ruff of Reed & Graham, Inc. "Before I had to change holders whenever the one I was using would get hot. Now, with DURO, I can weld a whole shift without the holder getting hot to my hand, even when using 5/16 in. hardfacing electrodes at high amperages."

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THE DURO "STANDARD"

- Another feature is the square guard. It protects hands from heat and also prevents rolling and grounding when placed on a flat surface. There when you need it, is a hex key fitted into the brass core and held in place by the fiber handle for making fast cable connections.

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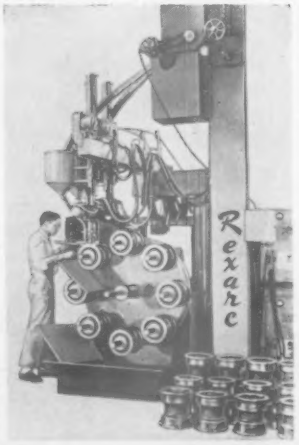
Revolutionary Rexarc

Enables high speed production rebuilding Rollers and Idlers



THE NEW REXARC MS-8 AUTOMATIC TWIN HEAD ROLLER REBUILDER—

has many outstanding features, power operated fully

The New Rexarc Automatic Flux Reconditioning System maintains automatically an adequate flux supply at all times eliminating manual flux handling—

Phone, wire or write today for complete information about this Revolutionary Profit Maker—

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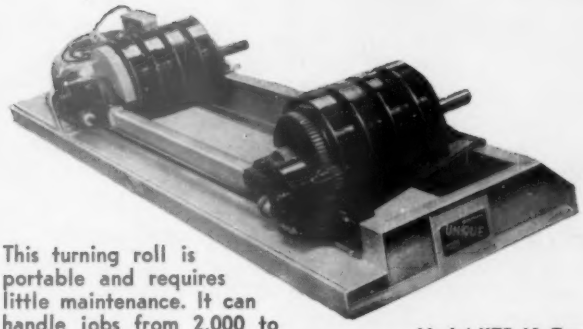
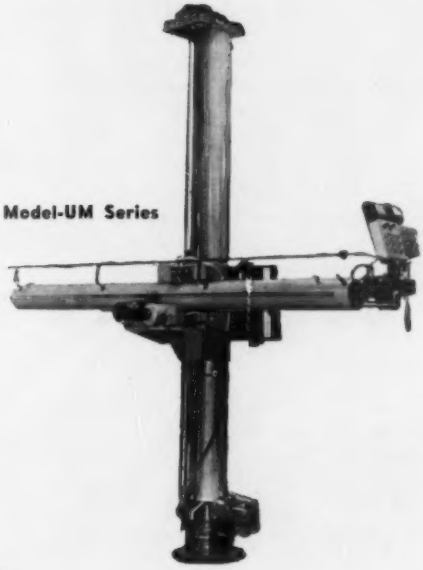
By using Unique equipment you can slash your welding costs in half, reduce handling of work, yet increase your welding production and perfection.



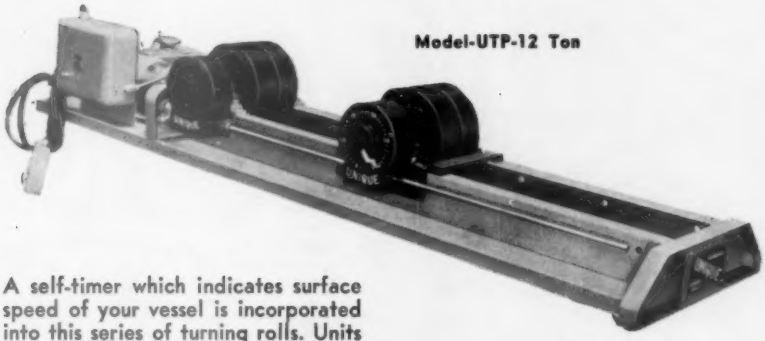
This turning roll is portable and requires little maintenance. It can handle jobs from 2,000 to 500,000 lb.

Model-UTP-60 Ton

Model-UM Series



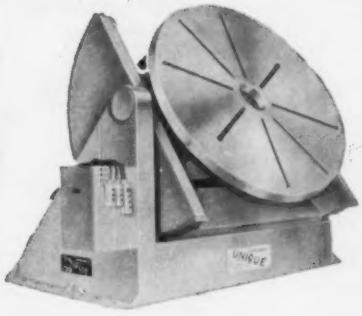
Model-UTP-12 Ton



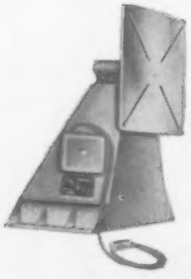
A self-timer which indicates surface speed of your vessel is incorporated into this series of turning rolls. Units are available with 3,000, 5,000, 10,000 and 20,000 lb capacities.

Here is a Unique welding head manipulator featuring variable speeds from 0 to 100 ipm. It has a double chain lift for safety, completely adjustable boom for leveling, and comes in sizes ranging from 6 by 6 ft, to 16 by 20 ft.

Welding positioners, when combined with other Unique equipment, will make your weldor a one-man production line—with push-button accuracy all the way. These precision gear-driven positioners are available in models ranging in capacity from 250 lb to 100 tons.



Model-UHDP-75 Ton



Unique Equipment, Inc.

Exclusive designers of positioning equipment

122 SUMPTER STREET BROOKLYN 33, NEW YORK

These head and tailstocks will provide you with variable or constant speeds, and can handle from 1,000 to 200,000 lb.

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WELDING MANAGEMENT

watches these developments

A NEW TEMPERING PROCESS that increases both strength and reliability of the strongest of the increasingly popular aluminum-magnesium alloys has been announced by the Aluminum Company of America. The process makes possible two new tempers. —H323 and —H343. Both assure maximum resistance to stress corrosion for sheet in alloys 5456 and 5083.

Alcoa now offers alloy 5083 sheet, in both the —H323 and —H343 tempers, with the same minimum guaranteed properties previously available in the —H32 and —H34 tempers. However, it now possesses superior resistance to stress corrosion.

In the new —H323 temper, alloy 5456—highest strength composition in the aluminum-magnesium series—now exhibits a four percent increase in minimum tensile strength over any previously available.

A SIGNIFICANT PRICE REDUCTION on much of its line has been announced by Smith Welding Equipment Corp., Minneapolis. P. E. Taylor, vice president in charge of sales, stated that refined methods and increased production facilities of a new plant wing will allow Smith to make this reduction.

SPARKING CHARACTERISTICS of various metals were tested at the Brooklyn Navy Yard. Test results are available in a report released by the U. S. Department of Commerce. The report concludes: "Metals, used in hand tools or other devices, that are safe to handle in an explosive atmosphere of gasoline vapor include manganese bronze, phosphorus bronze, aluminum bronze, commercial brass, aluminum and beryllium."

Copies of the report: "Research and Development Report on Sparking Characteristics of Metal" (PB-151650) are available for 50 cents each from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

COBALT ADDITIONS to chromium stainless steel have a favorable effect on their resistance to corrosion, say researchers of the Cobalt Information Center. Investigated were stainless steels containing 17 and 27 percent chromium and 9½ percent nickel. Cobalt additions ranged from 1.5 to 10 percent.

Tests were made by total immersion in sulfuric acid, intensiostatic and potentiostatic methods of electrochemical testings, and for susceptibility to integranular corrosion after heat treatment. The first tests confirmed that cobalt increases corrosion resistance in acid solutions; after appropriate heat treatments, the cobalt-alloyed steels showed diminished susceptibility to intergranular corrosion.

THE FIRST COMMERCIAL liquid air separation plant in Florida will be built at Tampa by Air Reduction Sales Co. The multi-million dollar installation will have a daily production capacity of 25 tons of high purity liquid oxygen, as well as liquid nitrogen and liquid argon. Ground was broken for the new plant last month. Completion is scheduled for this Summer.

WELDING EQUIPMENT MANUFACTURERS continue to develop attractive and practical packaging. Latest is Dockson Corporation which has announced that all welding and cutting outfits will be packaged in colorful, specially designed shipping-display cartons. The new packaging doubles as a sturdy shipping container of corrugated stock and as an eye-catching, point-of-sale aid for the distributor.

The cartons are printed in vivid orange and black design with areas for model number and price. A sturdy, die-cut hold-down pad keeps the various items in neat display, prevents shipping damage and parts loss from scattering or misplacement.

STEEL PRODUCTION crossed the 12-million-ton mark for the first time in January, 1960, according to the American Iron & Steel Institute. In that month, American steelmaking furnaces poured 12,043,000 net tons of ingots and steel for castings. The previous record for a month was 11,989,319 net tons made during December, 1959.

THE RECORD IMPORTS of foreign steel mill products—nearly 4.4 million tons during 1959—flooded into the United States through every major customs district, according to the American Iron and Steel Institute. Ports of entry on all shores—including the Great Lakes—received larger tonnages of steel imports than in 1958.

During 11 months of 1959, foreign steel imports were more than 150 percent greater than in the same period of the prior year. The increase amounted to 2.4 million tons.

FOREIGN WELDING PEOPLE continue their feverish efforts to "catch up" with the United States. This time it is the Japanese. They have purchased three Vertomatic machines for electroslag welding. According to H. E. Snyder, director of marketing for Acros Corp., the machines seem to have been bought without demonstrations, sectioning of welds and without extended correspondence.

American fabricators? They are still checking out the quality of electroslag welds prior to the placing of their first order.

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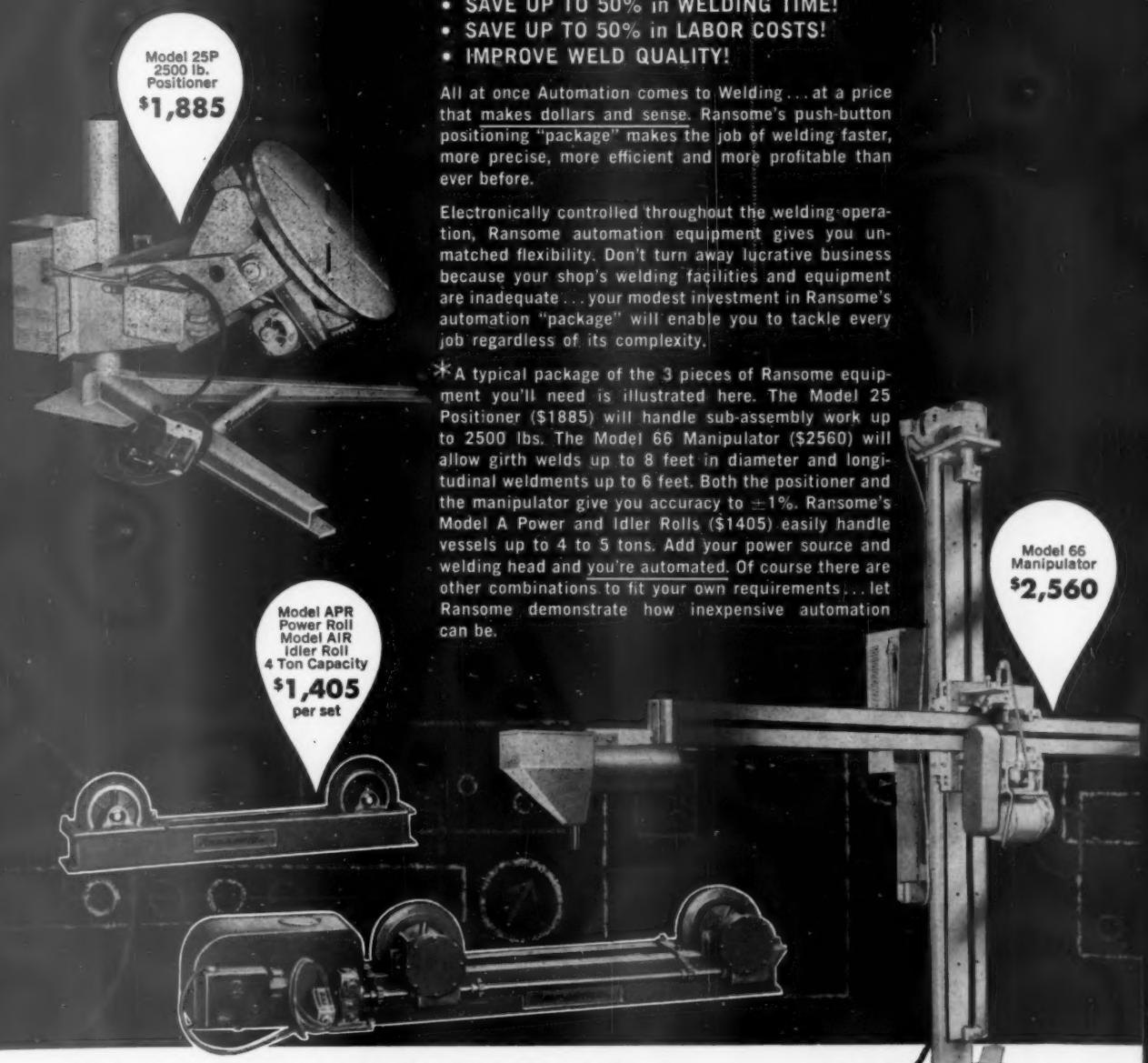
NOW! YOU CAN AUTOMATE YOUR WELDING FOR $5,850.*

- SAVE UP TO 50% in WELDING TIME!
- SAVE UP TO 50% in LABOR COSTS!
- IMPROVE WELD QUALITY!

All at once Automation comes to Welding . . . at a price that makes dollars and sense. Ransome's push-button positioning "package" makes the job of welding faster, more precise, more efficient and more profitable than ever before.

Electronically controlled throughout the welding operation, Ransome automation equipment gives you unmatched flexibility. Don't turn away lucrative business because your shop's welding facilities and equipment are inadequate . . . your modest investment in Ransome's automation "package" will enable you to tackle every job regardless of its complexity.

*A typical package of the 3 pieces of Ransome equipment you'll need is illustrated here. The Model 25 Positioner ($1885) will handle sub-assembly work up to 2500 lbs. The Model 66 Manipulator ($2560) will allow girth welds up to 8 feet in diameter and longitudinal weldments up to 6 feet. Both the positioner and the manipulator give you accuracy to ±1%. Ransome's Model A Power and Idler Rolls ($1405) easily handle vessels up to 4 to 5 tons. Add your power source and welding head and you're automated. Of course there are other combinations to fit your own requirements . . . let Ransome demonstrate how inexpensive automation can be.



See Ransome's standard off-the-shelf automation equipment at Booth 400 — The Welding Show, April 26, 27, 28—Los Angeles or write/ call Ransome for a demonstration in your area.

Ransome Company

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Division of Big Three Welding Equipment Co.

Scotch Plains, New Jersey

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Linde has all
continuous electrode
welding processes

Linde has a complete
line of equipment for
all of these processes

Linde leads
in modern methods
for joining metals

1936 - Unionmelt welding
1943 - Heliarc welding
1947 - Unionmelt multi-
electrode welding
1949 - Heliarc spot welding
1950 - Sigma welding
1951 - Sigma spot welding
1955 - Heliarc cutting
1956 - Unionarc welding
1957 - Sigma short arc welding
1958 - Pilot Arc starting
1959 - Plasmarc processes

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APRIL, 1960

Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

SPECIAL REPORT

The Impact of High-Strength Steels on the Welding and Fabricating Industry

WHY USE high-strength steels?

If a fabricator were looking only at cost-per-pound, mild steels would have it all over the high-strength steels. But, he isn't; he can't take this narrow view. High-strength steels have too many advantages to overlook. Because they are strong, high-strength steels cut deadweight to the bone. They let a designer use thinner sections that save space and weight. On mobile equipment this means more payload. On large fabrications and structures, it means using less steels —and it means much lower freight costs. High-strength steels give other bonuses: You can form them and you can weld them; they resist corrosion, abrasion, fatigue and impact much better than mild steels.

Few realize the size of the market for high-strength steels and the boxcar quantities of fabricating and welding equipment, filler metals and supplies needed to make these steels into products and structures. The table on the next page will give you an idea. The figures shown there are the latest released by American Iron and Steel Institute as part of report AIS 16-4, "Shipments of Steel Products by Market Classifications, Alloy (Other Than Stainless)" for the year 1959.

The table shows that the United States used almost 4-million tons of alloy steel. Of this total, 600,000 tons were low-alloy high-tensile steels, of which 87 percent was plate, structural shapes, and hot-rolled sheets used in welded construction.

The low-alloy high-tensile steels are one of the most important groups of the readily fabricated and welded high-strength steels. But, besides the low alloys there are two other high-strength groups used in large quantities. These are:

The intermediate steels (usually medium manganese) which are classified as nonalloy steels.

The engineering or structural alloys which are an important group. These contain more alloy than the low alloys and develop much higher properties through heat treatment. They include such steels as Great Lakes Steel's N-A-Xtra 80, 90, 100 and 110; U. S. Steel's T-1; Jones & Laughlin's Jalloy 280, 320, 360 and 400; and Republic's 65 and 70. We'll report in full on these structural alloys in an early issue.

How important is welding to this 4-million ton alloy steel market? It's of tremendous importance when you learn that 40-million pounds of low-alloy electrodes were produced in 1959. These were used to weld the major portion of the 4-million tons of alloy steel.

Another important fact: Consumption of low-alloy electrodes is accelerating. Electrode production for 1959 was more than 155 percent that of 1954. And, this growth parallels the increased use of alloy steel. The two are inseparable because the alloy steels must be fabricated and welded to utilize their properties to the fullest.

This four-part report on high-strength steels covers design advantages, fabricating, welding and case history applications. Accompanying it are two important charts you will want to save. The first (page 63) lists the manufacturers of low-alloy electrodes for welding the high-strength steels and the classifications in which their electrodes fall. The second chart (page 64-65) lists 36 of the high-strength steels, their properties and applications.

turn the page for information on designing and fabricating the high-strength steels

THE MARKET FOR HIGH-STRENGTH STEEL

CLASSIFICATIONS	NET TONS TOTAL ALLOY
Construction, Including Maintenance	
Residential	785
Non-residential	17,702
Highway	14,575
Public construction—other than highway	5,727
Rail transportation	2,106
Oil and gas	11,287
All other utilities	2,655
Steel industry—construction, maintenance, repairs and operating supplies (including own use)	33,702
Unidentified	11,880
Group Total	100,419
Contractors' Products	
Air conditioning and ventilating equipment	2,289
Builders' hardware	747
Culverts and concrete pipe	208
Plumbing and central heating equipment	6,688
Other contractors' products	5,480
Group Total	15,412
Automotive	
Automotive vehicles and parts (assemblers)	735,100
Automotive parts, accessories, and supplies (independent suppliers)	582,922
Automotive forgings	185,692
Group Total	1,503,714
Rail Transportation	
Railroad rails, trackwork, and equipment	5,169
Freight cars	155,527
Passenger cars	2,054
Locomotives	12,065
Street railways and rapid transit systems	2,095
Group Total	176,910
Shipbuilding and Marine Equipment	81,963
Aircraft	36,325
Oil and Gas Drilling	143,886
Mining, Quarrying, and Lumbering	20,694
Agricultural	
Agricultural machinery	25,150
All other agricultural	1,367
Group Total	26,517
Machinery, Industrial Equipment and Tools	
General purpose industrial equipment	345,997
Chemical industry equipment	1,831
Construction and related equipment	74,097
Food processing equipment	4,698
Metal working equipment	33,799
Pulp and paper equipment	1,311
Textile equipment	1,852
Other special industrial equipment	18,917
Tractors	88,629
Hand tools	30,991
Group Total	602,122
Electrical Machinery and Equipment	534,151
Appliances, Utensils, and Cutlery	
Cooking and space heating stoves	205
Refrigerators	5,591
Washing machines and ironers	893
Other household appliances	5,364
Utensils and galvanized ware	34
Cutlery and table flatware	2,173
Group Total	14,260
Other Domestic and Commercial Equipment	
Domestic furniture and other equipment	1,238
Office furniture, supplies and business machines	5,667
Other commercial, institutional, professional, and scientific equipment	4,420
Sporting goods, toys and signs	3,477
Group Total	14,802
Containers	
Cans—Sanitary	62
Crown caps and other closures	16
Steel barrels and drums—19 gage and heavier	22
Shipping pails	4
Compressed gas cylinders	15,401
Cooperage, boxes, strapping, and all other containers	440
Group Total	15,945
Ordnance and Other Military	18,581
Warehouses and Distributors	
Warehouses—oil and gas industry	233,038
Cooperatives	—
Mail order houses	44
All other warehouses and distributors—direct to customers	20,795
All other warehouses and distributors—for stock	268,722
Group Total	522,599

TOTAL ALL GROUPS .....3,812,724 NET TONS

MORE INFORMATION ON THE HIGH-STRENGTH STEEL MARKETING TABLE. The table (left) gives the gross tonnages of steels used in the major market classifications and their subdivisions. The popped-out portion (below) is an example of a further breakout of the totals showing the steel forms used in these classifications and tonnages. The example was chosen because pipe and tubes are major tonnage items in the Warehouse and Distributors market of high-strength steels. The same can be done for any of the other market classifications, to show, for example, the tonnages of structural shapes, plates, bars, hot-rolled or cold-rolled sheet or strip used in freight cars or in industrial machinery.

PIPES AND TUBES (NET TONS)

OIL COUNTRY GOODS	MECHANICAL TUBING	PRESSURE TUBING
230,320	132	1,619
—	—	—
—	—	—
3,639	5,498	2,032
41,153	5,759	5,372
275,112	11,389	9,023

PART 1 Designing

MORE THAN EVER, manufacturers want steels with special properties and characteristics. Today, they get these with a wide range of versatile high-strength steels.

A product may require a steel having good resistance to abrasion and fatigue; another may have to resist corrosion instead of abrasion; a third may have to resist shock and cyclic loading.

Each grade of high-strength steel is produced for one or more of these special purposes. This means their chemistries are different. One grade may be a medium manganese-copper steel; another may contain manganese, vanadium and copper; another will have chromium, nickel, silicon, copper, and phosphorus.

But, these high strength steels are readily formed and welded. And, they're strong. Most of them have yield strengths at least 50 percent higher than ASTM A-7 structural carbon steel.

LIGHTWEIGHT DESIGN

Weight is seldom an advantage to a product or a structure. Designers of mobile equipment always avoid

PART 2 Fabricating

HIGH-STRENGTH STEEL can be fabricated by the same methods as structural carbon steel. It is difficult to give specific rules for fabricating these steels because equipment and skills vary from shop to shop. The ex-

High-Strength Steel Weldments

unnecessary weight. It figures. The more payload a truck carries, the more money it makes for its owner. The high-strength steels make the lightest steel structures and in turn provide the greatest payloads. This is true of railroad cars, buses, trolleys and ships, as well.

High-strength steels can reduce the weight of stationary structures, too. If the design stresses for a product or structure are based on a steel's yield strength, the high-strength steels often permit unit stresses 1½-times those of structural carbon steels. Low-alloy high-strength steels have a 50,000-psi-yield; structural carbon steel yields at 33,000 psi. This means that a third of the weight can be eliminated. If the structure is loaded in compression or shear, high-strength steel's weight savings would be less because more metal is needed for rigidity. The average weight savings in this case would be 25 percent.

Most high-strength steels have the same elasticity as structural carbon steels. If you substitute them for the thicker carbon steel sections, there will be greater deflection in the structure. But since the modulus of elasticity is high—29-million psi—the deflection will be small.

When deflection must be controlled, the designer can do it in several ways. He can increase the depth of members; corrugate plates; shorten spans; or shift the load. With a little ingenuity he can save weight and still stay within the deflection limits.

Welds in high-strength steel have excellent properties. The low carbon contents of these steels aids welding and keeps the welds ductile. The yield strength of a low-alloy high-tensile steel with 0.15 carbon is equal to that of a straight-carbon steel containing 0.30 carbon, and the welding characteristics are better. If a steel contains much carbon, a weld in it will air-harden and become brittle. This usually means that straight-carbon steels with yield strengths around 50,000 psi have to be preheated before welding. If they aren't, the welds may crack. And it isn't always possible, or practical, to preheat.

The High-Strength Steels

perienced fabricator will have no trouble in devising procedures to suit his setup.

COLD WORKING

You can cold work high-strength steel on a press brake, draw bench, or other fabricating equipment. This steel has a much higher yield point than structural carbon steel; more force is needed to give it a permanent set. Thin sections seldom require more forming pressure than structural carbon steel.

When you cold work high-strength steel, allow for larger bend radii, slightly larger die clearances, and for more springback than you would for structural carbon steel. These are differences, not difficulties, and they disappear when the shop gets used to them.

HOT FORMING

When thickness or shape of part prevent cold forming, you can hot form. For best results, form or press between 1,550 and 1,650°F. Don't form high-strength steel below 1,200°F. High-strength steel won't harden on cooling, so heat treatment after forming is unnecessary.

PUNCHING AND SHEARING

You'll usually need heavier, more secure clamping when you punch and shear high-strength steel. The reason: you need 20 percent more force than with structural carbon steel.

SAWING, MILLING, AND DRILLING

Cutting the high-strength steels, like forming them, requires 20 percent more power than needed for the structural carbon steels. To get the most tool life, run them at one-third less the speed you use for structural carbon steel.

FLAME CUTTING

The same procedures are used to flame cut high-strength steel as for structural carbon steel. Cutting speed, heat effect, and smoothness of cutting are about the same for both steels.

NORMALIZING OR ANNEALING

If high-strength steel has to be normalized or annealed, do it at these temperatures: Normalize at 1,650°F and air cool; anneal at 1,550°F and furnace cool. One of these treatments may be necessary to get maximum ductility before severe cold working.

STRESS RELIEVING

It's sometimes necessary to stress relieve high-strength steel after cold forming. If it is, do it at 1,150°F. Hold the work at temperature one hour for each inch of the thickest section.

PART 3

Welding The High-Strength Steels

HIGH-STRENGTH STEEL can be welded by all welding processes: shielded metal arc, submerged arc, resistance and gas.

Some high-strength steels, such as those containing up to 0.25 carbon and 1.60 manganese, should be welded with low-hydrogen electrodes to avoid cracking. Spot welding of these alloys is not recommended.

Low-alloy high-tensile steel weldments made of thin sections have greater toughness than those made of thick sections. For some applications, toughness is best if thicknesses are limited to ½ inch.

SHIELDED METAL ARC WELDING

You can weld many of the high-strength steels with covered mild steel electrodes (Iron and Steel Arc Welding Electrodes, ASTM 233-58T, covering the E60XX electrodes). Welds made with these electrodes will have greater yield strength than the base metal. Mild steel deposits in plate up to ½-inch thick will have tensiles at least as good as the base metal, even without weld reinforcement. Weld elongation will be about the same as in structural carbon steel.

When you weld metal thicker than ½ inch, use the low-alloy electrodes of AWS E70XX or E80XX groups. Welds made with either mild-steel or high-tensile steel electrodes will have about the same ductility as deposits on structural carbon steel. Welds in thicker low-alloy steels won't be as ductile unless the weldment is preheated. If you aren't sure about preheating, ask the steel producer or electrode manufacturer for recommendations.

Don't weld high-strength steels with bare electrodes; such welds are neither strong enough nor ductile enough.

Most high-strength steels harden during arc welding, but not enough to make preheating and stress-relief annealing necessary. The mild steel weld metal remains strong enough to develop the full strength of the base metal.

Long-time exposure tests made on several low-alloy high-tensile steels welded with mild steel electrodes show little difference in the corrosion resistance of the weld, the heat affected zone, and the base metal.

Many high-strength steels are commonly welded to each other and to structural carbon steels without difficulty. Mild steel electrodes are used in most cases. Some high-strength steels can be satisfactorily welded to austenitic stainless steel. The best electrode to use in this combination is an austenitic stainless electrode. It is not advisable to arc weld the high-strength steels to nonferrous metals without considerable experimentation. It's a good idea to consult with the steel producer before you go too far with dissimilar metal welding.

SUBMERGED ARC WELDING

High-strength steel is readily welded by submerged arc with the same electrodes used for welding mild steel. The mechanical properties of the welds are usually at least as good as that of the base metal. Weld ductility will be about the same as submerged arc welds made in mild steel.

RESISTANCE WELDING

Most high-strength steels can be resistance welded: spot, seam, projection, flash, upset, and percussion. Spot welding, however, is not recommended for some of the medium manganese grades. Some of the high-strength steels can also be resistance welded to plain carbon steel, and to austenitic stainless steel. Don't try to resistance weld high-strength steels to non-ferrous metals without careful investigation.

Most of the high-strength steels can be spot welded if they aren't thicker than ⅛ in. They take the same welding time, pressure, and current as you would use in spot welding low-carbon steel. The shear strengths in most of these steels are considerably greater than spot welds in mild steel.

GAS WELDING

Most high-strength steels can be gas welded. Unlike metal-arc welding however, mild steel deposits are not strong enough to join the high-strength steels. High strength gas welding rods (Iron and Steel Gas Welding Rods, ASTM A251, GA-65 group) may develop the full strength of these steels; but where 100 percent joint efficiency is necessary, it is best to use rods which will deposit weld metal having a tensile strength in excess of 70,000 psi. The weld ductility will be less than that of metal-arc welds of equivalent strength.

turn to page 64 for a comprehensive comparison chart that lists 38 widely used high strength steels

WHERE TO BUY LOW-ALLOY STEEL ELECTRODES FOR WELDING HIGH-STRENGTH STEELS*

AWS A5.5-58T; ASTM A316-58T

MANUFACTURER	E7010-A1	E7010-G	E7011-A1	E7015-A1	E7016-A1	E7016-G	E7018-A1	E7018-G	E7020-A1	E8011-B1	E8013-B2	E8013-G	E8015-B1	E8015-B2	E8015-B2L	E8015-B4L	E8015-C1	E8015-C2	E8015-C3	E8016-B1	E8016-B2	E8016-C1	E8016-C2	E8016-C3	E8016-G	E8018-B1	E8018-B2	E8018-C1	E8018-C2	E8018-C3	E8018-G	E9010-G	E9015-B3	E9015-B3L	E9015-D1	E9016-B3	E9016-D1	E9016-G	E9018-B3	E9018-D1	E9018-G	E10013-G	E10015-D2	E10015-G	E10016-D2	E10016-G	E10018-D2	E10018-G	E11015-G	E11016-G	E11018-G	E12015-G	E12016-G	E12018-G
Air Reduction Sales Co.	●		●						●												●	●		●												●					●				●	●					●			
Alloy Rods Co.							●																			●		●	●								●													●		●	●
All-State Welding Alloys Co. Inc.						●																																															
Arcos Corp.															●						●	●	●	●					●			●			●				●			●			●					●	●		
Champion Rivet Co.				●			●								●	●		●						●		●							●			●	●		●				●									●			
Harnischfeger Corp.	●		●			●	●	●	●											●	●	●		●		●	●		●						●			●	●	●			●	●	●		●				●	●	●	●
Hobart Brothers	●					●																				●		●									●											●				●			●
Lincoln Electric Co.	●	●							●																														●	●											●			
Lukens Steel Co.	●		●		●		●		●											●	●	●	●	●		●	●	●	●	●					●	●		●	●	●			●	●			●				●	●	●	●
Marquette Mfg. Co.								●		●																															●													
McKay Co.						●		●																●				●		●																						●			●
Metal & Thermit Corp.	●					●		●	●					●							●	●		●								●			●						●		●	●	●						●			
National Cylinder Gas Div. of Chemetron Corp.	●		●						●																												●																	
Reid-Avery Co.	●		●	●	●	●	●		●				●	●			●	●	●	●	●	●	●	●	●	●	●	●	●	●		●		●	●	●		●		●		●	●	●	●	●	●	●	●	●	●	●	●	●
Shober, Inc.	●							●																																														●
A.O. Smith Corp.	●				●	●			●		●										●						●		●		●				●										●		●	●			●	●		
Victor Equipment Co.	●		●			●		●	●			●									●														●							●		●		●								
Westinghouse Electric Corp.	●					●			●																																													

*See pages 64-65 for steel tradenames, properties, and applications

READILY FABRICATED AND

PRODUCER	NAME	MECHANICAL PROPERTIES		
		Tensile, PSI	Yield, PSI	Elong, % in.
American Tank & Fab. Co.	Amera-Mag	70,000 min. (to ¾") 67,000 min. (¾ to 1½")	50,000 min. (to ¾") 46,000 min. (¾ to 1½")	28-2" (to ¾") (¾ to 1½)
Armco Steel Corp.	High Strength No. 1	70,000 min.	50,000, min.	22-2"-sheets 18-8"-plates
Armco Steel Corp.	High Strength No. 2	64,000	45,000	27 in 8"-plates
Armco Steel Corp.	High Strength No. 3	60,000	40,000	35-2"
Armco Steel Corp.	High Strength No. 4S	70,000, min.	50,000, min.	22-2" (under .180) 18-8" (over .180)
Armco Steel Corp.	High Strength No. 5	Sheets-60,000 min. Plates-70,000 min.	45,000 min. 50,000 min.	25-2" min. 18-8" min.
Bethlehem Steel Co.	Mayari R	70,000 min (¾" & under)	50,000 min. (¾" & under)	18 min.-8", 22 min-2" (¾" & under)
Bethlehem Steel Co.	Medium Manganese	75,000 min. (To ¾", incl)	50,000 min (To ¾", incl.)	18 min.-8", 20 min.-2" (sheets) (to ¾" incl)
Bethlehem Steel Co.	Manganese Vanadium	70,000 min. (¾" & under)	50,000 min. (¾" & under)	18-8" min. (¾" & under)
Crucible Steel Co. of Amer.	Maxeloy	70,000 (½" & under)	50,000 (½" & under)	22-2" (½" & under)
Great Lakes Steel Corp.	GLX-45-W	65,000	45,000	22-8"
Great Lakes Steel Corp.	GLX-50-W	70,000	50,000	28-8"
Great Lakes Steel Corp.	GLX-55-W	75,000	55,000	28-8"
Great Lakes Steel Corp.	GLX-60-W	80,000	60,000	28-8"
Great Lakes Steel Corp.	N-A-X High Tensile	70,000 min.	50,000 min.	28
Great Lakes Steel Corp.	N-A-X Finegrain	70,000 min.	50,000 min.	28
Great Lakes Steel Corp.	N-A-X High Manganese	70,000 min.	50,000 min.	22
Inland Steel Company	Hi-Steel	70,000 min (¾" & under)	50,000 min (¾" & under)	18-8" (¾" & under)
Inland Steel Company	Tri-Steel	70,000 min (¾" & under) 60,000 min (sheet & strip)	50,000 min (¾" & under) 45,000 min (sheet & strip)	18-8" (¾" & under) 25-2" (sheet & strip)
Inland Steel Company	Hi-Man	75,000 min (½" & under)	50,000 min. (½" & under)	18-8" (½" & under)
Inland Steel Company	Special Hi-Man	75,000 min (½" & under)	50,000 min. (½" & under)	18-8" (½" & under)
Jones & Laughlin Steel Corp.	Jalten #1	70,000 (To ½" incl.) 67,000 (½" to 1")	50,000 (To ½" incl) 47,000 (½" to 1")	22 (to ½" incl) 22 (½" to 1")
Jones & Laughlin Steel Corp.	Jalten #2	70,000 (To ½" incl.) 67,000 (½" to 1") 65,000 (C/R, to 15Ga.)	50,000 (To ½" incl) 47,000 (½" to 1") 45,000 (C/R to 15Ga.)	22 (To ½" incl) 22 (½" to 1") 25 (C/R to 15Ga)
Jones & Laughlin Steel Corp.	Jalten #3	70,000 (To ½" incl) 67,000 (½" to 1")	50,000 (To ½" incl) 47,000 (½" to 1")	22 (To ½" incl) 22 (½" to 1")
Kaiser Steel Corp.	Kaisaloy #1	70,000 min (¾" & under)	50,000 min (¾" & under)	22-2"
Kaiser Steel Corp.	Kaisaloy #2	65,000 min	45,000 min	25-2"
Kaiser Steel Corp.	Kaisaloy #3	90,000 min (½" & under)	60,000 min (½" & under)	
Lukeens Steel Company	Manganese Vanadium	70,000 min (¾" & under) 67,000 min (¾" to 1½")	50,000 min (¾" & under) 46,000 min (¾" to 1½")	18-8" min (¾" & under) 19-8" (¾" to 1½")
Republic Steel Corp.	Republic "50"	70,000 H/R	50,000	22-2"
	Republic "M"	75,000 H/R	50,000	20-2"
United States Steel Corp.	USS Tri-Ten	70,000 (¾" & under)	50,000	18-8"
	USS Cor-Ten	70,000 (To ½") 65,000	50,000 45,000	18-8" 22-2"
	USS Man-Ten	75,000 min (½" & under) 70,000 min (½" to 1½")	50,000 (½" & under) 45,000 (½" to 1½")	20-2" (½" & under)
Alan Wood Steel Co.	Dynalloy I	70,000 min. (½" & under)	50,000 min (½" & under)	18-8", min. (½" & under)
	Dynalloy II	67,000 min (½" & under)	45,000 min (½" & under)	
Youngstown Sheet & Tube Co.	Yoloy	70,000	50,000 min.	27-2"
Youngstown Sheet & Tube Co.	Yoloy "E"	70,000	50,000 min.	22-2", min.
Youngstown Sheet & Tube Co.	Yoloy A-242	70,000 min	50,000 min.	20-2", min.

*The engineering or structural alloys listed on page 59 will be treated similarily in an early issue.

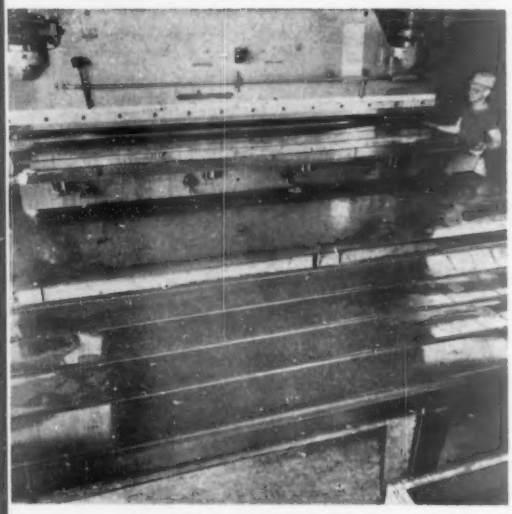
WELDED HIGH-STRENGTH STEELS*

Charpy Keyhole Impact, Ft. Lb.	REMARKS—A: Characteristics B: Principal Alloys C: Typical Applications
35, room temp.	**A:** Hot strength; resists abrasion; good weldability. **B:** Mn, P-Al Killed.
	A: Corrosion resistance; superior mechanical properties. **B:** Mn, Cu, Ni; **C:** Truck bodies, railroad cars, barges, handling, construction and military equipment, structural.
	A: Excellent corrosion resistance; good formability. **B.** Mn, Cu, Ni; **C:** Coal hopper car sides, ends, bottoms.
	A: Strong, drawing steel; good plating surface. **B:** V. **C:** Automobile bumpers.
	A: High strength. **B:** C, Mn. **C:** Pressure vessels, truck bodies & frames, railroad cars.
	A: High strength; impact resistance. **B:** Mn, V. **C:** R.R. car frames, truck bodies, construction & industrial equipment.
45, room temp.	**A:** Corrosion, impact, and abrasion resistance; workable, weldable; long-paint life, withstands low temps; is non-air hardening. **B:** P, Si, Cu, Cr, Ni, Zr. **C:** Machines, structures, equipment—trucks, cranes, conveyor, excavating mining, chemical containers, bridges, pipeline fittings, penstocks.
30, room temp.	**A:** Resists corrosion and abrasion; moderate formability; weldable. **B:** Mn, Cu. **C.** Applications requiring high strength and weight saving.
50, room temp.	**A:** Corrosion, abrasion, fatigue resistance; workable, weldable, withstands low temperatures and severe shock. **B:** Mn, V, Cu. **C:**Same as Mayari R.
	A: High strength, light weight, resists corrosion and impact, good weldability, formability, non-air hardening **B:** Mn, Ni, Cr, Cu. **C:** Machines, structures, equipment-rail, bus, truck, maritime, mining, construction.
22, room temp.	
22, room temp.	**A:** High strength, weldable steels, good formability. **B:** Cb. **C:** Propane cylinders, tubing, structural members.
22, room temp.	
22, room temp.	
58, room temp.	**A:** Low temp. toughness; excellent corrosion resistance; fatigue life; abrasion resistance. **B:** Cr, Zr, Si. **C:** Truck bodies, tubing, structurals, cranes, earthmoving equipment.
53, room temp.	**A:** Low temp. toughness; excellent fatigue life, surface finish. **B:** Si, Zr. **C:** LPG Cylinders, unfired pressure vessels.
40, room temp.	**A:** High strength and endurance limit; abrasion and corrosion resistance; good workability & weldability. **B:** Mn. **C:** Cylinders, cranes, cars, earthmovers, trucks and trailers.
Superior	**A:** Excellent atmospheric corrosion resistance; abrasion resistance; fatigue properties, weldability. **B:** Mn, Mo, Ni. **C:** Constructional uses.
Superior	**A:** Excellent fatigue and abrasion resistance. Good weldability. Atmos. corrosion resistance 2 x carbon steel. **B:** V. **C:** Constructional uses.
Good	**A:** Good abrasion and fatigue resistance. Atmos. corrosion resistance 2 x carbon steel. Weldable. **B:** Mn. **C:** Constructional uses.
Fully killed, fine grain, better than Hi-Man.	**A:** Good abrasion and fatigue resistance. Atmos. corrosion resistance 2 x carbon steel. Weldable. **B:** Mn. **C:** Constructional uses.
	A: High strength; good formability. Twice resistance to atmospheric corrosion of mild steel. Readily weldable. **B:** Mn, Cu, V. **C:** machines, structures, eqpt., truck bodies, cranes, bridges, pipe-line fittings, booms.
	A: High strength, moderate forming. To 6 x atmospheric corrosion resistance of mild steel. Readily weldable. **B:** Mn, P, Cu. **C:** machines, structures, equipment-truck bodies, cranes, bridges, pipe-line fittings, booms.
	A: High strength, moderate forming. Twice atmospheric corrosion resistance of mild steel. Readily weldable. **B:** Mn, Cu. **C:** machines, structures, equipment-truck bodies, cranes, bridges, pipe line fittings, booms.
	A: Better corrosion resistance than mild steel. Readily weldable. Good abrasion and fatigue resistance. **B:** Cu, Mo, Cr, Ni, V, Ti, Al. **C:** bridges, truck bodies and frames, cement mixers, missile handling systems, containers, heavy construction eqpt.
	A: High strength, good formability and atmospheric corrosion resistance. **B:** Cu, Mo, Cr, Ni, V, Ti. **C:** Parts produced by cold forming.
	A: Extra high strength, exceptional wear resistance-resists battering and impact. Readily weldable. Cold forming limited. **B:** Cu, Mo, Cr, Ni, V, Ti. **C:** Trucks, barges, impact & abrasion-resisting applications.
	A: High strength. **B:** Mn, V. **C:** Bridges, construction, railway.
	A: Resists atmospheric corrosion 4 x carbon steel. Good welding. High strength and toughness. Good abrasion resistance. **B:** Cu, Ni, Mo, Cr. **C:** Agricultural implements, mine, and railroad cars, materials handling equipment, earthmoving equipment, trucks, trailers.
	A: High strength, resistance to abrasion and fatigue. Moderate formability and weldability. Twice as corrosion resistant as carbon steel. **B:** Mn, Cu. **C:** Earthmoving equipment.
42, room temp.	**A:** Strength and toughness with less weight. Good formability, weldability. Withstands moderately severe impact. **B:** Mn, V. **C:** Earthmoving equipment, cranes, bridges, truck bodies, pipeline fittings, booms.
40, room temp.	**A:** Corrosion resistance to 6 x that of carbon steel. High strength. **B:** Cu, Cr, Ni. **C:** RR cars, farm equipment, air preheaters, buses, mine equipment, material handling equipment, marine applications, poleline hardware.
30, room temp.	**A:** High strength for applications involving moderate forming. **B:** Mn, Cu. **C:** Booms, buckets, concrete mixers, earthmoving equipment, cylinders, trucks, trailers, mining cars.
50, room temp. (V-notch)	**A:** Abrasion, atmospheric, fatigue, and impact resistance; formable; weldable. **B:** Mn, Cu, Ni, Mo. **C:** Chassis and framework-trucks, buses, trailers, and railroad cars.
120	**A:** High strength and good ductility; low temperature impact; corrosion resistance. **B:** Cu, Ni.
50	**A:** High strength and good ductility; corrosion resistance. **B:** Cu, Ni, Cr.
	A: High strength, abrasion resistance. **B:** Mn, Cu, V.

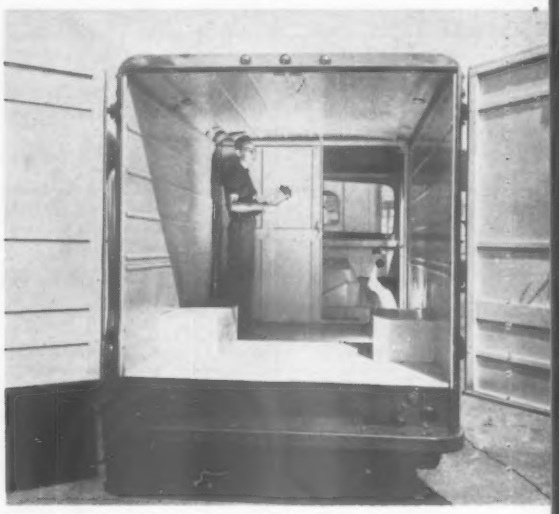
PART 4

High-Strength Steels At Work

The case histories which follow are only a few examples of how high-strength steels are used to make lighter, stronger and economical welded fabrications and structures.



GOOD FORMABILITY and excellent weldability help speed production of delivery truck body.



DESIGN FLEXIBILITY made possible by high strength steel gives large, unobstructed interior.

Welded High-Strength Steel Makes Lighter, Stronger Delivery Truck Bodies

BOYERTOWN, PA.: What is the most serviceable metal for delivery truck bodies?

The answer is high strength steel, according to engineers at Boyertown Auto Body Works.

DESIGN DETAILS

Boyertown reports that high strength steels provide the best all-around cost, weight, strength and corrosion factors in delivery truck body construction. It seems to satisfy the owner, the driver, and the maintenance man.

Boyertown uses 22, 18, 14 and 12 gage high strength steel for its exterior and interior panels, posts, ribs, cross members, floors, door, and windshield assemblies. Jones & Laughlin's Jalten No. 2 is used.

The owner is interested in light weight. This contributes to lower operating costs. By using high strength steels in a 12-foot forward control delivery truck body, Boyertown has been able to reduce weight 600 to 650 pounds. Of course, this is done without sacrificing strength.

The driver is interested in convenience. The high strength steels give Boyertown design flexibility. This permits making bodies with large, unobstructed interiors.

The maintenance man likes high strength steels for these reasons:

- High strength steel resists impact and abrasion better than mild steel. This means dents, when they do occur can be easily "bumped" out.
- Boyertown uses standard mill size sheets when it can. Speedy and inexpensive repairs are possible because replacements can be ordered directly from a steel warehouse.
- The high strength steel used by Boyertown has a corrosion resistance four to six times that of mild steel. • •

turn to page 70 to see how Goodyear made a lighter, stronger radar antenna yoke

It's easy on the welder
It's flexible . . it's tough

Yes, Belden Welding Cable is "easy on the welder." It's engineered and manufactured to be extremely pliable, limp and flexible. Result: more production . . better quality . . lower costs.

And Belden Welding Cable is rugged . . rough and ready for the most severe conditions of abrasion, impact, as well as exposure to heat, cold, and oil.

Belden has a welding cable engineered for every possible welding requirement . . Oil Tempered Rubber Jacketed . . Neoprene Jacketed . . HVF Vinyl Plastic Jacketed . . Whip Lead, Super-flexible and Neoprene Jacketed . . Neocote colors for identification . . Rubber Jacketed Welder Supply Cords.

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Belden Welding Cable comes in many ready-to-use package lengths.

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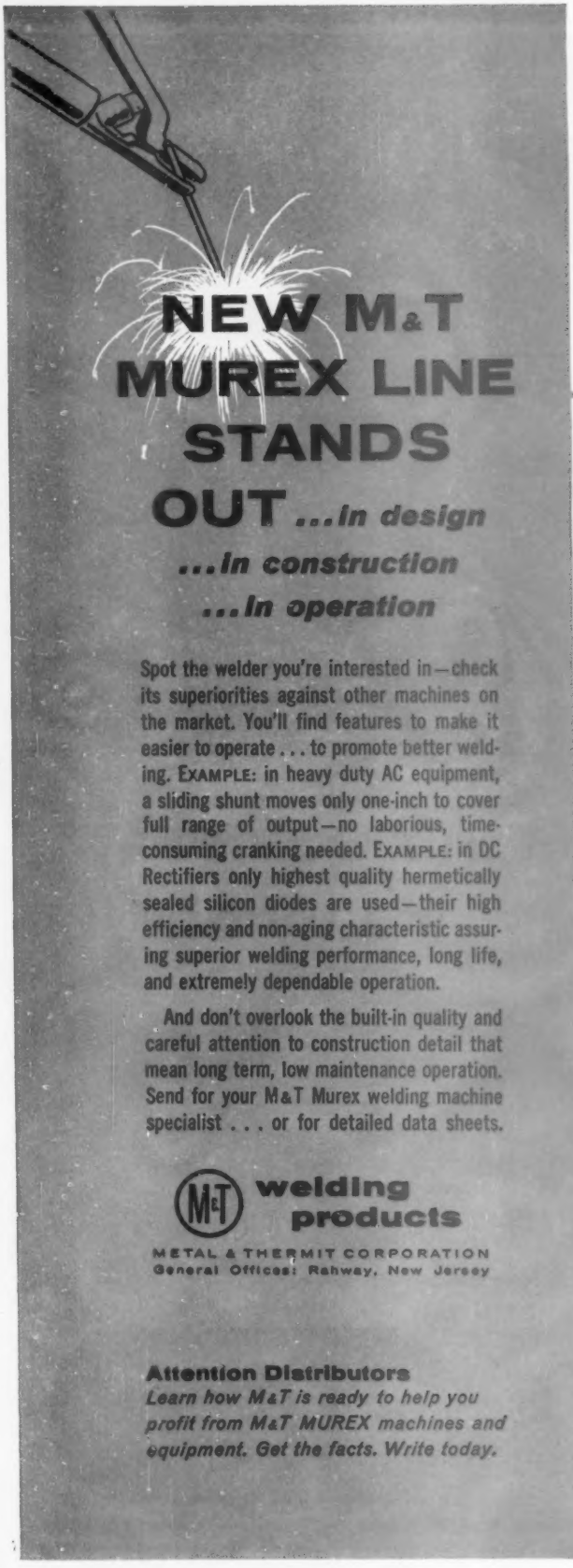
one wire source for everything electrical and electronic

magnet wire • lead wire • power supply cords • cord sets • portable cordage • electronic wire • control cables • automotive replacement wire and cable • aircraft wire

18-1-0



NEW M&T MUREX LINE STANDS OUT ...in design ...in construction ...in operation

Spot the welder you're interested in—check its superiorities against other machines on the market. You'll find features to make it easier to operate . . . to promote better welding. EXAMPLE: in heavy duty AC equipment, a sliding shunt moves only one-inch to cover full range of output—no laborious, time-consuming cranking needed. EXAMPLE: in DC Rectifiers only highest quality hermetically sealed silicon diodes are used—their high efficiency and non-aging characteristic assuring superior welding performance, long life, and extremely dependable operation.

And don't overlook the built-in quality and careful attention to construction detail that mean long term, low maintenance operation. Send for your M&T Murex welding machine specialist . . . or for detailed data sheets.

M&T welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Attention Distributors
Learn how M&T is ready to help you profit from M&T MUREX machines and equipment. Get the facts. Write today.

1. AC-DC COMBINATION WELDERS
for convenience and economy

Patented dual transformer and hermetically sealed silicon diodes provide high arc stability and smooth steady arc for all AC and DC welding conditions. Stepless current control with single wheel adjustment. Available in 200, 300, 400 amp sizes.

4. MURETRAN* ALL-PURPOSE WELDERS *highly versatile units for any welding job*

Simple switching and plug-in controls permit rapid changeover from inert gas arc welding to manual, automatic, spot MIG and TIG welding. Unique plug-in control panel provides automatic timing of gas pre-flow, gas post-flow, high frequency drop-out and spot arc. Models for AC-DC or AC operation.
*Trademark

7. AC ARC WELDERS
for medium duty welding

Compact, all-purpose 180 amp portable arc welders for light manufacturing, maintenance or farm welding. Have automatic, built-in volt-arc characteristics that provide deep penetrating arc at high amperage, soft arc at lower settings. No moving parts, no maintenance.

10. HIGH FREQUENCY ARC STABILIZER
for inert gas arc welding

Converts any AC or DC welder for inert gas shielded arc welding. Completely automatic. Has foolproof gas after-flow device. Reduces gas costs. Remote control switch. Also available with water valve shut-off and timer. 230 volt, 0-600 amps capacity.

For More Information Circle No. 67 on Reader Service Card.

2. DC RECTIFIER WELDERS

for economical, heavy duty service

Hermetically sealed silicon diodes deliver high efficiency and non-aging characteristics. Instant recovery voltage provides high stability and easy striking and maintenance of the arc. Simple current range selectors and a single control knob simplify machine setting. Available in 200, 300, and 400 amp sizes.

3. AC INDUSTRIAL ARC WELDERS

for heavy-duty production welding

Unique transformer design with patented dual coil produces high arc stability for smooth, steady welding. No moving coils: steel shunt travels only one-inch to provide full stepless range of output. Forced air cooling. Instant arc starting. Models with 200, 300, 400 and 500 amp rated output.

5. INERT ARC AC WELDERS

for heavy-duty inert gas arc welding

Foolproof, built-in gas afterflow device eliminates complicated timers. Stepless amperage control provided by steel core which slides only one-inch for full range. Automatic remote control systems operate gas, water, high frequency and primary power from torch. May be used for metallic arc welding. Models with 200, 300, and 400 amp rated output.

6. AC ARC WELDERS

for production, maintenance and shop welding

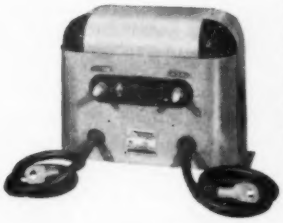
Wide current range from 7 to 300 amperes. Delivers 200 amperes at 50% duty cycle. Automatic built-in voltage control gives deep penetrating arc at high outputs, soft arcs at lower settings. 66 heat settings.

8. AC ARC WELDERS

complete, portable welding outfit

Low cost complete welding outfit for light requirements. Good penetration on metals up to ¼-inch plate. Also available: M&T Model 91 Arc Torch for brazing, soldering and heating work. Rated to 95 amp output.

9. HIGH FREQUENCY ARC STABILIZER *for metallic arc welding*



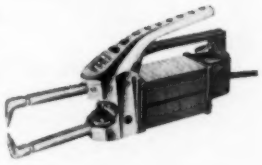
Gives instant start with any AC or DC welder, any electrode. Stabilizes arc to prevent burn through on low-current settings for thin gauge welding. Remote control available. 230 volts, 0-600 amps capacity.

MUREX
PRODUCTS FOR BETTER WELDING

11. PORTABLE SPOT WELDER

for sheet metal and wire

Simple, light and rugged. Fixed upper tong is positioned on exact welding spot, providing better contact than welders that must be brought up to the work. Lower jaw comes up to exact underside spot. Welds mild steel, stainless, and galvanized iron to ⅛-inch combined thickness. Wide range of tong configurations.



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General Offices: Rahway, New Jersey

I am particularly interested in the equipment checked below.

☐ Have representative phone for appointment. ☐ Send data sheets.

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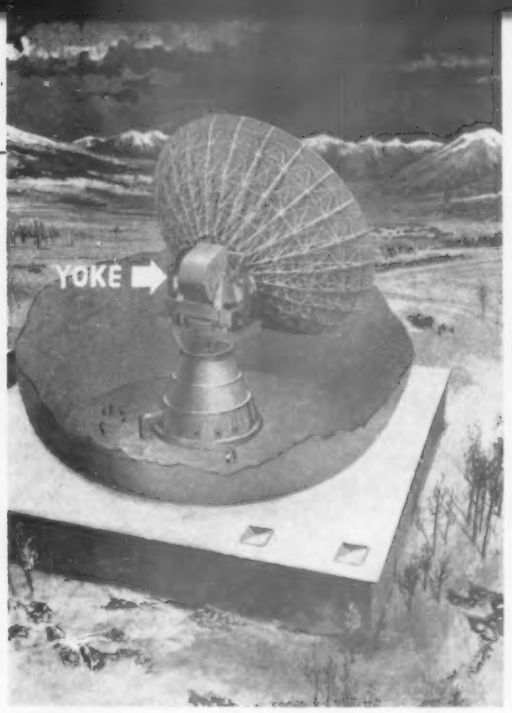

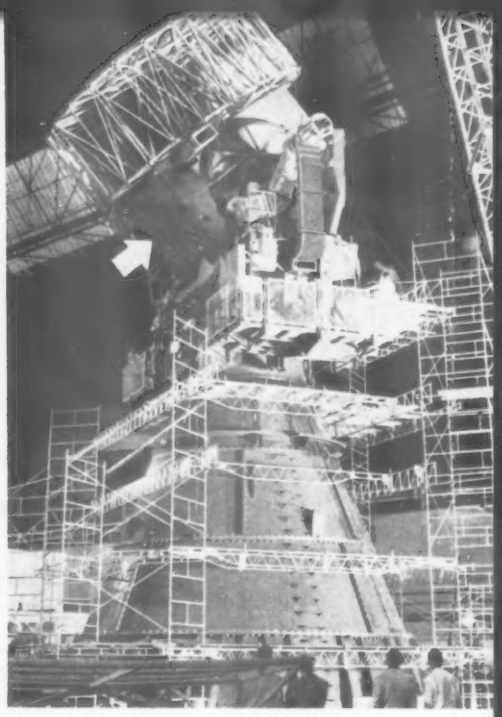

WELDED YOKE is key part of missile tracking stations for Ballistic Missile Early Warning System. Yoke supports 13,000 pound radar tracking antenna.

Welded High-Strength Steels Reduce Weight Of Radar Yoke By 25%

AKRON, OHIO: Giant radar stations will guard the North American continent against attack by intercontinental ballistic missiles.

Goodyear Aircraft Corp. has just completed the radar structure for the first of these Air Force installations. Work was done for the prime contractor, Radio Corporation of America.

The missile tracking stations are part of BMEWS (Ballistic Missile Early Warning System). The BMEWS stations detect missiles on gigantic radars, while electronic computers track the missiles and predict their targets. Stations will be located at Thule, Greenland; Clear, Alaska, and Flyingdale Moor, England.

DESIGN

The radar structures are just plain big. The 84 foot diameter aluminum antenna weighs over 13,000 pounds and is one of the largest ever built. The pedestal, on which the antenna rests, is 50 feet high. Together the overall structure weighs nearly 375,000 pounds. Despite this great weight, the units can be rotated precisely. They can complete a scan of the skies in a few seconds.

When installed, the radar structures will rest on a base three stories high and 145 feet square. A 140-foot diameter plastic spherical radome, also made by Goodyear, will protect the structures from the elements. The entire installation will be 176 feet high.

MATERIALS AND FABRICATION

A variety of metals was used to fabricate the radar structures. These include the weldable grades of low alloy high tensile steels with a carbon content of no more than 0.35 and to corrosion- and heat-resisting alloys. This includes steel in the SAE 900, 1000, 4100 and 8600 range and the SAE 300 stainless steel series. The steels used were covered by military specification MIL-S-13281.

For the pedestals, steels up to an inch thick were used. These pedestals were purposely made in sections so they could be bolted and unbolted during re-installation mechanical testing of the radar units.

The main drive gear that rotates the antenna is made of alloy steel and weighs 9,000 pounds. It rests on 75 three-inch alloy steel balls which are nested in the supporting ring. This supporting ring rests on the pedestal. It is also made of alloy steel and weighs 10,600 pounds.

text continues on page 73

MATERIAL SPECIFICATIONS FOR MISSILE TRACKING STATIONS

N-A-X 9115 ALLOY STEEL

SOURCES: Great Lakes Steel Corp. and Lukens Steel Company

CHEMICAL ANALYSIS:

Carbon	0.10-0.17%	Silicon	0.60-0.90
Manganese	0.50-0.80	Chromium	0.50-0.75
Phosphorous	0.04 max	Molybdenum	0.15 max
Sulphur	0.04 max	Zirconium	0.05-0.15

YOLOY "E" HSX

SOURCE: Youngstown Sheet & Tube Co.

CHEMICAL ANALYSIS:

Carbon	0.18% max	Copper	.20/ .50
Manganese	0.90 max	Nickel	.40/1.00
Phosphorous	0.05 max	Chromium	.20/ .35
Sulphur	0.05 max		

U.S.S. TRI-TEN

SOURCE: United States Steel Corp.

CHEMICAL ANALYSIS:

Carbon	0.22 max	Silicon	0.30 max
Manganese	1.25 max	Copper	0.20 min
Phosphorous	0.04 max	Vanadium	0.02 min
Sulphur	0.05 max		

NICKEL STEEL (similar to A-203 Grade "A")

SOURCE: Any vendor

CHEMICAL ANALYSIS:

Carbon	0.23 max	Sulphur	0.05 max
Manganese	0.90 max	Silicon	.15/ .30
Phosphorous	0.04 max	Nickel	2.0 /2.75

MANGANESE-VANADIUM

SOURCES: Bethlehem Steel Co. and Lukens Steel Co.

CHEMICAL ANALYSIS:

Carbon	.22 max	Silicon	.30 max
Manganese	1.25 max	Copper	.20 min
Phosphorous	.04 max	Vanadium	.02 min
Sulphur	.05 max		

SAE 4130

Where availability and/or delivery make is economically feasible, 4130 normalized steel to the following Government specification may be used in lieu of the steels just listed:

AN-QQ-S-685	QQ-S-626
MIL-S-18729	QQ-S-624
MIL-S-6758	

FILLER METAL SPECIFICATIONS

MATERIAL TO BE WELDED	FILLER REQUIRED	COMMERCIAL DESIGNATION
Steel 0.35% Max C		
SAE 900 Series		
SAE 1000 Series	AWS E8018-C2	3½ Ni
SAE 4100 Series		by any process
SAE 8600 Series		

Stainless Steel	AWS	By any process
18-8 Cr-Ni	Type 308	308
18-8 Cb or Ti	Type 347	347
18-8 Mo	Type 316	316
18-8 Mo-Cb	Type 318	318

NEW M&T FACT FILE

on Murex low-alloy and mild-steel electrodes

Here's the new "encyclopedia" of all M&T MUREX low-alloy and mild-steel electrodes. It's an important, handy reference that any welding man will want to have—and use.

Each of the 32 cards gives you pertinent data you need to choose the right electrode: AWS number, color markings, general use, welding characteristics, chemical analysis of deposit, tensile strength, yield point, elongation, reduction of area, sizes, type of current and amperage. Another card gives heat treating data for all commonly used types of low-alloy and mild-steel.

One of the broadest lines available, MUREX electrodes enable you to choose the one type and size that is just right for the job. Send for this Fact File *now*.

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METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Attention Be sure to visit Booths 603-604 during Welding Show in Los Angeles April 26-28 where you can enter the BIG M&T CONTEST FEATURING A 1960 AUTOMOBILE AS THE PRIZE.

MUREX
PRODUCTS FOR BETTER WELDING

For More Information Circle No. 101 on Reader Service Card.

HIGH-STRENGTH STEEL RADAR YOKE

continued from page 70

A welded yoke rests on the drive mechanism and supports the antenna. Goodyear made the yoke from low alloy high tensile steel. Originally, it was scheduled to be made from 4130 normalized steel.

By using low alloy high strength steel, Goodyear reduced the yoke's weight about 25 percent—to about 44,000 pounds—without sacrificing strength. As it is, a 300 hp motor is needed to rotate the antenna. You can see that more weight on the drive mechansim would call for more power.

WELDING

Goodyear's general specifications thoroughly covered the manual and automatic welding of corrosion- and heat-resisting alloys and steels.

The following reference specifications were also used:

ASTM: *A*-298-48*T* covers the following filler rods: Type 308 (Cr-Ni); Type 316 (Cr-Ni-Mo); Type 318 (Cr-Ni-Mo-Cb) and Type 347 (Cr-Ni-Cb).

AWS: *E*8018-*C*-2 covers 3½ nickel low hydrogen iron powder welding electrodes used on low alloy high tensile steels.

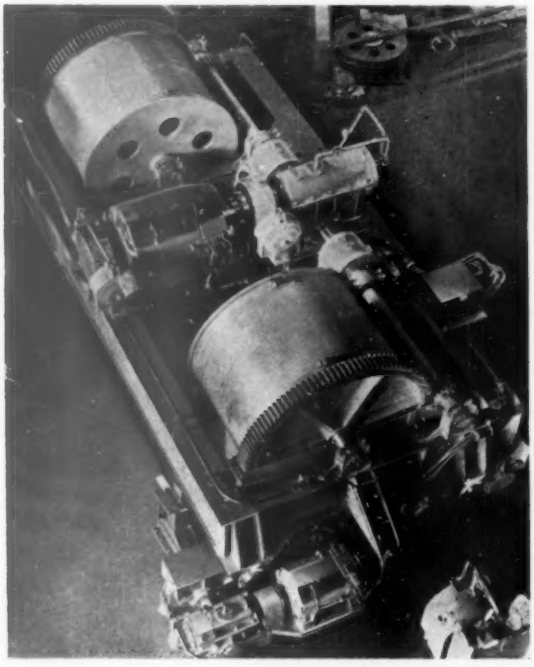
Military: These specifications were used; *MIL-A*-4144 (Argon, Gas Welding); *MIL-T*-5021 (Test, Aircraft Welding Operators Certification); *MIL-I*-6865 (Inspection, Radiographic); *MIL-I*-6866 (Inspection, Penetrant) and *MIL-I*-6868 (Inspection, Magnetic Particle).

Joint Army-Navy: *JAN-STD*-19 covers welding symbols. • •

Welded high strength steel trolley frame and span increase crane efficiency 32%

ALLIANCE, OHIO: Careful material selection and careful design analysis helped Morgan Engineering Co. solve a problem for a steel mill.

Problem: A steel mill wanted to install a 200-ton capacity crane on existing runways and columns. Mild steel construction would have meant a heavier crane. In turn this would have called for an addition to the building housing the crane and the addition of new columns and runways.



Solutions: Morgan's Engineering Department suggested using a low alloy high tensile steel instead of mild steel. The assigned engineers designed a welded crane with trolley frame and span made from low alloy high strength steel.

This cut the weight of the crane by 40 percent and increased operating efficiency by 32 percent. The alloys most commonly used at Morgan are Mayari-R, Man-ten, Dynalloy, and Yoloy.

DESIGN CONSIDERATIONS

Morgan was concerned with the deflection of the span when it was placed under load. To take care of this deflection, Morgan's engineers used a flange on the tension side to approximate a deep I-beam on the vertical members of the crane and the trolley frame.

FABRICATION

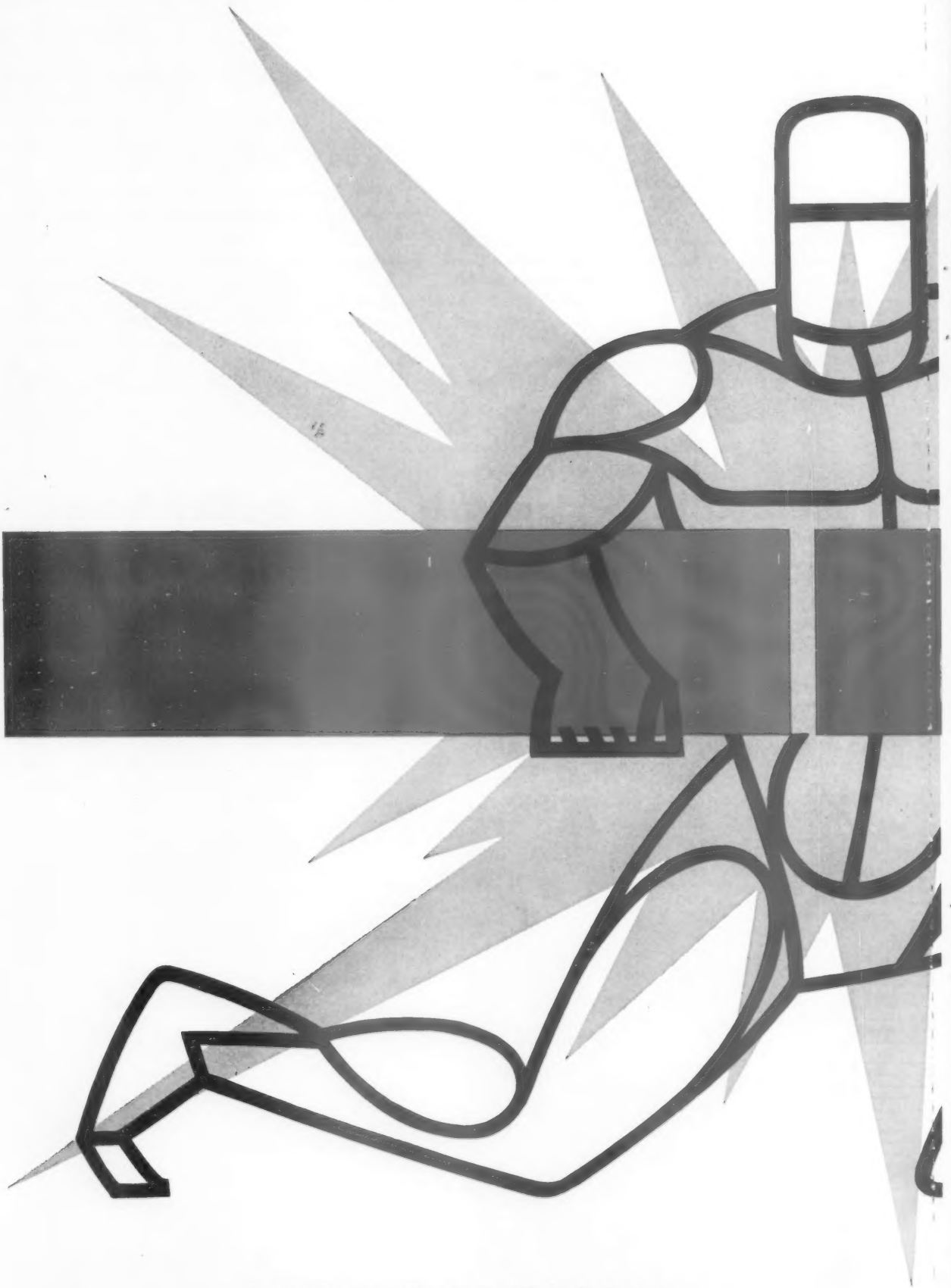
E. H. Burke, vice president of engineering, reports there were no fabricating problems. Existing equipment and previous experience with low alloy high tensile steels made fabricating easy.

WELDING

Morgan's Chief Welding and Development Engineer, Bill Evans, was concerned with possible underbead cracking. Morgan used E7018 low hydrogen iron powder electrodes to make sure this did not happen.

Automatic welding presented no problems. Standard automatic welding wires and fluxes were used. • •

turn to page 76 to see how stronger steels lighten fork lift trucks



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Stronger Steels Lighten Fork Lift Trucks

CLEVELAND: In a fork lift truck what's ahead of the front axle has a lot to do with the size and weight of the truck, its ability to handle loads, to maneuver in tight places, and its cost. Towmotor Corporation, a leader in fork truck manufacture, begrudges an extra ¼ inch ahead of the axle, especially between the axle and the fork face. They keep weight and bulk down by using high-strength steel.

DESIGN CONSIDERATIONS

Think of a fork lift truck as a see-saw, with the front axle the fulcrum. The heavier and bulkier the parts are in front of the axle, the more counterweight you pile on behind it to compensate. But counterweight takes space and the added size might make the difference between the truck clearing small aisle intersections in turning or hanging up in them.

High-strength steel is about 50 percent stronger than mild steel. Mild steel parts, therefore, have to be bigger to make up this strength. In front of the axle, the bulk and weight of mild steel parts move the trucks's center of gravity forward; it might take 100 lb. of counterweight to offset it. This could cost the manufacturer $10 a truck.

So the designers specify high strength steel for front end parts. It's usually a 58,000-psi-yield 80,000-psi-tensile steel or straight-carbon SAE 1040 or 1045. The straight carbons are as strong as the high strength steel and actually a little cheaper, but they have one drawback. They air-harden near a weld or a flame-cut edge much more than the high-strength steels. This plays hob with tools during machining.

The Towmotor designer is even more interested in keeping down weight and bulk on front-end attachments. Examples: fork extensions, upenders, scoops, rams, roll and bale clamps, unloaders, drum carriers. The high-strength steels keep attachments slim, yet strong enough to do their job.

These steels give Towmotor a big jump on competitors that use mild steel for front-end attachments. If the customer wants a roll clamp, the competition may have to propose a larger truck than Towmotor to offset the mild steel clamp.

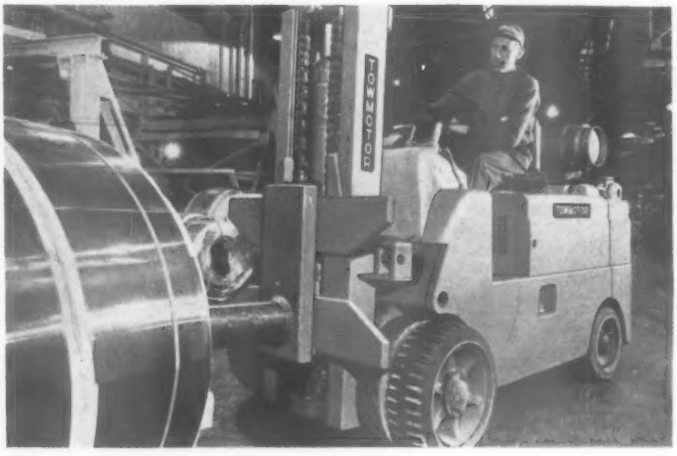
FABRICATION AND WELDING

Towmotor doesn't find that the high-strength steels cost any more to cut, shear, bend, or weld than mild steel. It works just like mild steel, without special preparation. They even use E6024 mild steel electrodes to weld it, unless there are dissimilar steels in the assembly. If there are, they'll use E7016 low hydrogen electrodes. Because most lift truck welds are short, most of Towmotor's welding is manual.

The carriage assembly for a standard fork truck is made of high-strength steel bars, ¾ to 1¼ inches thick. The side bars are beveled at the top corner joints to provide a deep weld. These joints are reinforced with inside fillets. The bottom bar is fillet welded to side bars on three sides and butt welded on the fourth.

Towmotor fixtures most weldments. This provides time-after-time accuracy, sometimes as close as 0.015 inches, that make parts run smoothly and last long.

How much high-strength steel does Towmotor use? You can get an idea by the fact that they buy 65 percent of their needs direct from the mill. And you have to use a lot to qualify for mill quantities. • •



HEAVY COILS of strip steel are handled by this 1200 lb. truck. The truck will swing in the least possible space because most parts ahead of the front axle are made of space-saving, high-strength steel.

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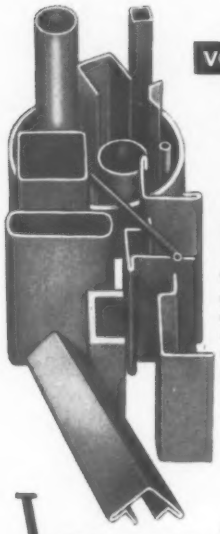
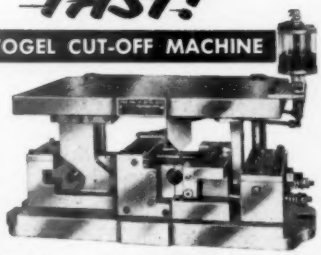
FAST!



VOGEL CUT-OFF MACHINE



With each press stroke, unit accurately cuts off tubing and shapes into lengths of ½" ±.010", or more. The ends are cut clean with a minimum of burr or distortion . . . Shearing blades make thousands of cuts before resharpening.

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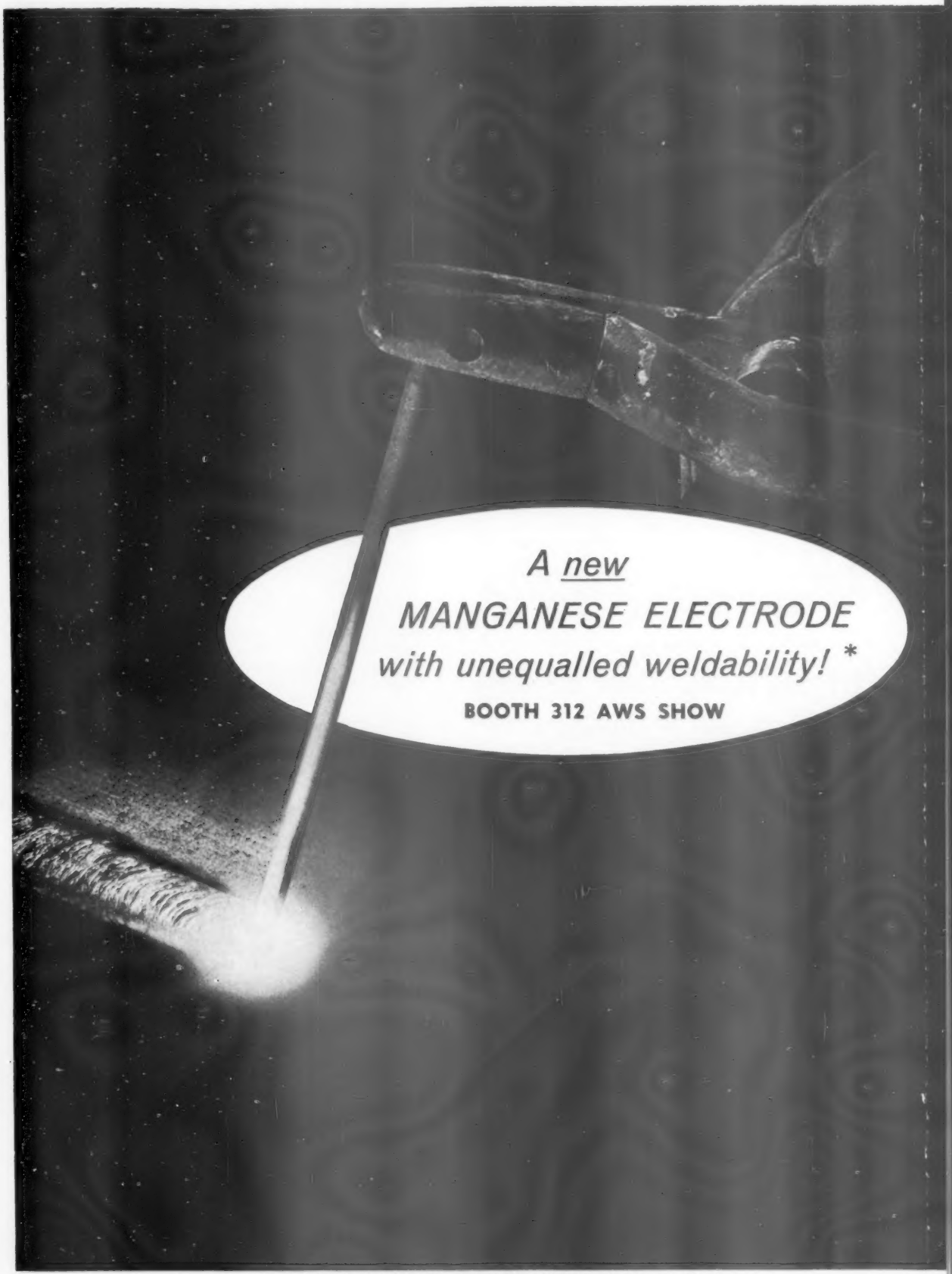

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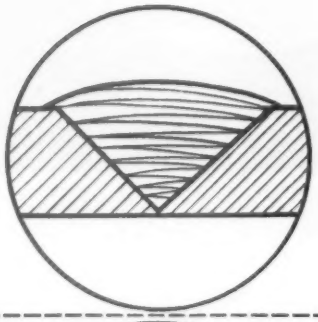
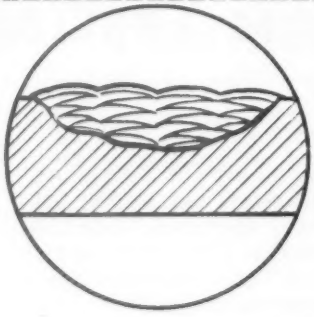
STOODY NICKEL MANGANESE

WITH IRON POWDER COATING



FOR JOINING



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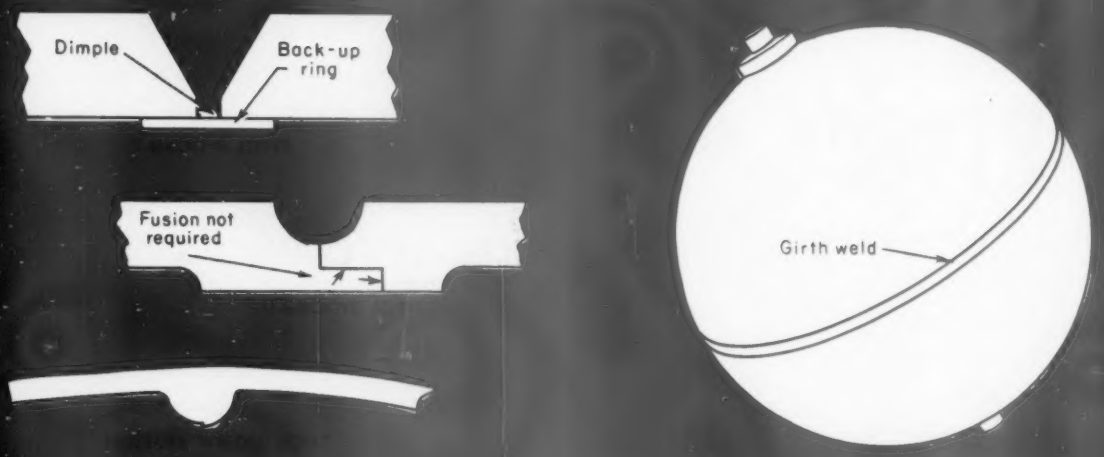


THREE DIFFERENT JOINTS are used in girth seams on titanium storage bottles. Design of the U-groove joint serves the same purpose as the V-groove joint's backing ring. Upset metal is still present on inner surface of pressure welded joint; outer surface has been machined flush.

Techniques For Ultrasonic Testing

by **E. R. FOOR,** *senior engineering metallurgist, Convair-Astronautics, A Division of General Dynamics Corp., San Diego*

IN BRIEF: An explanation of how ultrasonic inspection techniques were developed for detecting flaws in fusion and pressure welded titanium joints

WE HAD TO MAKE nondestructive tests on some pressure vessels of 6A1-4V titanium alloy. Helium storage bottles on the Atlas ICBM, these spherical vessels are made by fusion or pressure welding two forged hemispheres.

All the vessels are pressure-proof tested, and some, selected according to a sampling plan, are pressure tested to destruction. The fragments show poor quality girth welds cause premature failure. You can actually see the defects (lack of fusion and porosity) in the welded parts of the fragments.

FUSION WELDING

In fusion welding one to three fusion passes (with no filler metal added) and at least two filler passes with filler metal added are used (multiple pass welding minimizes shrink cracking). Bottle fragments show that the most serious defect in the girth fusion welds is a lack of fusion of filler wire weld passes with the previously made fusion passes. This is a severe, propagating-type defect.

Different subcontractors fusion weld these vessels. Each uses different joint designs and welding techniques. This makes testing the welds even more difficult. Some defects are most prevalent in one kind of joint than another. And, defects are apt to occur with different orientations within the welds.

PRESSURE WELDING

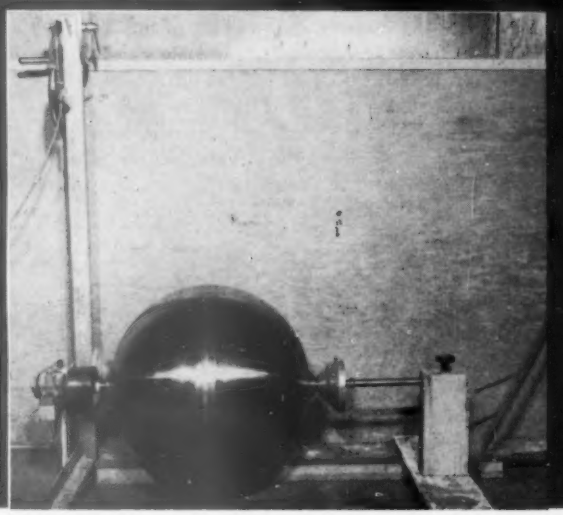
In pressure welding, the sphere is made by forcing the two hemispheres together while an oxy-acetylene flame heats the rims. The likely defects: A thin layer of oxides or other nonmetallics in the center of the weld joint perpendicular to the bottle surface, a line of lack of bond, and possibly some mismatch of the hemispheres.

If a pressure bottle fails in service, it would certainly cost a missile, a test stand and lives. We had to find a reliable nondestructive testing method. Even though we pressure-proof test every vessel, there is no way of knowing whether the next pressure application (possibly in a missile) would make it fail. We had to know the actual internal quality of each part before we could use it safely.

Over-designing couldn't be considered because it would add additional weight. Weight saving was one of the reasons for using a titanium alloy.

some instances, incomplete root penetration. Lack of fusion and sometimes incomplete root penetration were

enter the material to be inspected through a couplant (water or oil). The sound waves travel through the



FINISHED STORAGE BOTTLE is positioned in jig for ultrasonic inspection (above). Bottle is immersed in water and a 15-mc lithium sulfate 3/8-inch diameter crystal is used to produce sound waves. Results are recorded; in this case a definite lack of continuous fusion was indicated.

Of Titanium Pressure Vessels

INSPECTION PROBLEMS

At first we use radiography on all the welds. It was difficult because of the shape of the vessels. We used a double wall technique. The X-rays went through the upper wall of the bottle, traveled through 25-in. of air inside the bottle, and left through the lower bottle wall. This technique allows X-ray diffusion and scattering. The radiograph loses sensitivity and contrast. This limits its reliability as a single acceptance nondestructive test.

Next, we hung a radioactive source inside the sphere. It was found that the sensitivity level of the gamma graphs was too low, so we stayed with radiography with the double wall technique.

Radiographic tests were often inconclusive because they did not reveal the entire internal condition. Burst bottle fragments sometimes showed defects in the welds the radiographs previously showed were sound.

VARIETY OF WELD DEFECTS

Not all weld defects are easy to find by X-ray inspection. Radiography detects porosity and cracks satisfactorily. However, it has shortcomings in detecting the lack of fusion of weld passes.

Lack of fusion in the girth welds usually occurs in a horizontal or nearly horizontal plane (perpendicular to the X-ray beam). The defect is flat, extended crack-like, usually not deep or thick enough to absorb enough x-rays to affect the X-ray film. Experience shows that you cannot notice a lack of fusion on X-ray film unless the flow curves upward or downward on its edges (in a half moon pattern). Where the defect is curved, only the two edges which are more parallel to the X-ray beam appear on the radiograph. Then a confusing railroad track pattern shows up on the finished radiograph.

In many cases we could not detect lack of fusion radiographically. A sphere judged sound on radiographic quality standard might still contain the rejectable flaw: propagating lack of fusion within the weld zone.

FUSION WELDED JOINTS

Two companies that fusion weld bottles use different joint designs. One is a standard single V-groove with no back-up ring. Both are welded from only one side.

The welds of both joints are apt to contain porosity, cracks, and lack of fusion. (Some incomplete root penetration was noted in the U-groove weld joint.) X-ray inspection detected porosity, cracks and, in

design had a curvature on the inner surface (bottom) in the weld area. Machining had been done to provide

most common defect is lack of bond or a very thin layer of nonmetallics lying vertically within the weld

some instances, incomplete root penetration. Lack of fusion and sometimes incomplete root penetration were not detected. Therefore, it was decided that radiography should be supplemented by another means of non-destructive testing ultrasonic inspection.

PRESSURE WELDED JOINTS

The pressure welded joint introduced new problems. Microscopic studies of welded sections showed only very thin nonmetallic lines of demarkation in the center of the weld. Nonmetallics are probably caused by insufficient upset of material during welding or by dirty interfaces.

The defects are perpendicular to the surface and are very thin. Radiography by the necessary double wall technique was of very little value. When the inspector tilted the bottle for X-ray examination, the nonmetallic layer was no longer parallel to the X-ray beam and was never recorded on the radiograph.

Sound waves can detect flaws by reflection and absorption, not by absorption alone (as do X-rays). We thought ultrasonic inspection would detect very thin defects such as nonmetallic layers.

INVESTIGATE ULTRASONICS

Our Engineering Department determined the feasibility and reliability of ultrasonics for inspecting the vessels. They did the work in cooperation with Automation Instruments Incorporated, Paramount, California.

The equipment consisted of Immerscope Model 424A coupled to an Ultragraph Recorder, Model 1010. The part, in a jig, was submerged in water.

The Immerscope produces electrical pulses. A crystal (usually quartz or lithium sulfate) converts them into mechanical vibrations. These vibrations enter the material to be inspected through a couplant (water or oil). The sound waves travel through the material until they strike an interface or sound interruption. They are reflected back to the crystal and are retransformed into electrical pulses. The pulses are displayed on a cathode ray tube. The inspector can measure the severity and position of the flaw.

The Ultragraph, connected to the Immerscope, plots the ultrasonic indications of defects on a cathode ray memory tube. Certain areas of the Immerscope pattern can be eliminated or gated out, and the tube presentation can be photographed. This picture is much like a radiograph. The inspector can see the actual size and shape of the flaws. Interpretation is simple, accurate and reliable.

Ultrasonic inspection techniques were developed on fragments of burst bottles. For comparison purposes, we first X-rayed the fragments. They were fragments not whole bottles, so we didn't use the double wall technique of radiographic inspection.

This gave radiographs with better sensitivity. The design of the V-groove fusion welded joint made it compatible with longitudinal wave ultrasonic inspection. This technique introduces sound waves directly into the material. The crystal face is parallel to the material surface.

A radiograph of a fragment welded by the V-groove fusion joint showed the typical railroad track indicating lack of fusion. This was not detected on radiographs of the whole bottle made by the double wall technique.

INSPECTION TECHNIQUES

We used a standard ultrasonic testing technique on the fragments. We immersed a fragment in water, and used a 15-mc lithium sulfate, 3/8-inch diameter crystal to produce sound waves. The Ultragraph record showed definite lack of continuous fusion. They were photographed for comparison with radiographs and metallographic section. By metallographic sectioning and preparation, we proved there was a lack of fusion of the first filler wire weld pass to the root fusion passes.

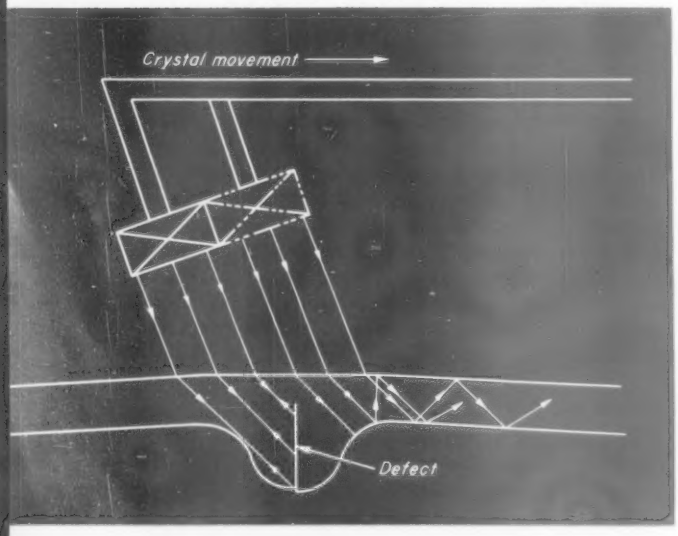
The experimenters found that the photo could be used to measure width and length of the flaw. Precise measurements of the actual defect in the metallographic section and of the ultrasonic indication proved that the Immerscope-Ultragraph combination inspection and recording was reliable and precise.

Ultrasonic inspection revealed only lack of fusion in the particular fragment tested. This was the only defect found radiographically and metallographically. Experience has shown that bottles with V-groove welds are relatively free of porosity and cracks.

The results showed that ultrasonic inspection and recording were satisfactory for nondestructively testing the welds of the V-groove fusion welded joints. (Applying the technique to U-groove fusion welded joints and pressure welded joints still had to be done.)

V-GROOVE WELDS

The same method (longitudinal sound wave inspection) was tried on the U-groove welds. The results were confusing and perhaps unreliable. The joint



THIS SOUND WAVE PATTERN is used for shear wave inspection of pressure welded joints. This type of inspection introduces sound waves at a slight angle to the material surface; this minimizes the effects of the vessel's surface curvature.

design had a curvature on the inner surface (bottom) in the weld area. Machining had been done to provide for a heavier section in the area of the weld and guard against weld failure. We suspected the sound waves reflecting from the curved and machined inner surface and the unfused area of the joint were causing the ultragraph to record a confusing double-image flaw pattern.

We decided that a shear wave method of ultrasonic inspection might minimize the effects of the surface curvature. Shear wave inspection introduces sound waves at a slight angle to the material surface. Upon entering the material, the sound waves refract and travel at about 45° angle from top surface to bottom surface, etc., until they strike a reflecting discontinuity or gradually die out.

This worked. Further, we verified the accuracy of our testing by the same method we used on the V-groove weld. We inspected fragments by X-ray. Again we avoided the double wall technique. We detected some porosity, but apparently there was no lack of fusion.

We inspected the fragments ultrasonically. The same equipment (the Immerscope coupled to the Ultragraph) and the same crystal (a 15-mc., 3/8-inch diameter lithium sulfate transducer) was used. Sound was introduced into the material at 19° from the vertical. It refracted to 45° within the material. Inspection and recording were done as before.

A strong flaw indication was detected in an area which, according to the radiograph, was sound. We recorded the flaw and photographed it.

Metallographic examination showed there was a lack of fusion of a filler metal weld pass to a previously made pass.

Additional ultrasonic scanning revealed still another area in which flaws were detected. According to the radiograph, these were porosity. Metallographic sectioning showed porosity entrapped in the weld metal.

The comparison of shear wave recorded ultragraphs with metallurgical samples showed that direct measurements on the Ultragraphs could not be made for any defect dimension except length. The length of defect was accurately presented, but not the width. Had the defect been orientated perpendicular to the material surfaces, height would have been accurately depicted due to the scanning movement of the crystal. Sound waves would have struck the wall-type defect at continually different areas along its height because of crystal movement, hence sound entrance points during scanning.

Standard shear wave test blocks are required to determine dimensions of defects occuring horizontally in the weld.

Cross comparisons of Ultragraph recordings, radiographs, and metallorgraphic specimens had proved that ultrasonic inspection was a valuable nondestructive test for both fusion welded joints. Now the technique had to be adapted to the pressure welded joint.

INSPECTING PRESSURE WELDED JOINTS

We examined typical pressure welded joints. The most common defect is lack of bond or a very thin layer of nonmetallics lying vertically within the weld at the interface of the hemispheres. These defects are easily detected by shear wave ultrasonic inspection. The sharp curvature of the upset material on the inner surface of the weld rules out using longitudinal wave inspection.

DETECT MISMATCHING

Ultrasonic inspection easily detects mismatching of hemispheres during pressure welding. This is done by longitudinal sound waves.

To check for defects within the weld, we introduce shear waves into the material at an angle of 19° to the vertical. The sound refracted to a 45° angle and progresses through the material reflecting from the top and bottom surfaces until it strikes a flaw.

Crystal movement during scanning was started about 1½ inches from the weld joint centerline and moved toward the center of the weld. We examined the entire weld joint this way.

The Ultragraph recorded strong sound reflections. The presentation showed a defect extending the entire length of the weld but mostly in the upset metal area. No flaw was found by radiography. Metallographic sectioning revealed a thin layer (0.004 inch thick) of nonmetallics lying in the center of the weld area. The Ultragraph makes this flaw look very severe; under the microscope it seems very minor. This is because the amount of sound energy returned to the crystal and on to the recording instrument depends on the area of the flaw nad not its thickness. In order to determine thickness, the energy level of the sound waves must be varied. This can be done by adjusting the Gain of the Immerscope.

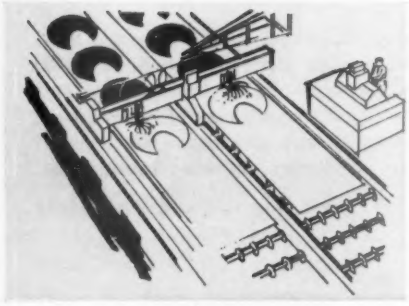
The correlation of Ultragraphs, radiographs, and metallographic sections showed that ultrasonic shear waves were feasible for inspection of pressure welded joints.

It was also seemed necessary that the presence of mismatch, if any, be detected. This took new adaptation of Immerscope-Ultragraph.

It happened that the test fragment used did contain a hemisphere mismatch. This mismatch was detected ultrasonically because the instruments showed a material thickness on either side of the weld centerline.

The Ultragraph provides a way to electronically eliminate a part of the reflected sound pattern. This is called gating. The accompanying diagram shows the sound wave pattern and gating technique used to detect differences in a material thickness. The mismatch itself was not shown. Its presence showed in its effects on overall weld joint material thickness.

To detect the mismatch, we gated the Ultragraph to the bottom surface of the thinner half of the weld. Anything thicker was not recorded because all sound reflections from such an area were electronically damped and eliminated from presentation on the screen. As the crystal scanned across the thicker area to a thinner area within the gate, recording again commenced on the screen. • •



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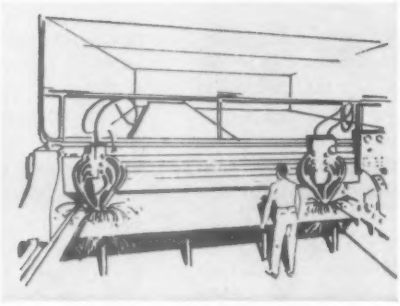

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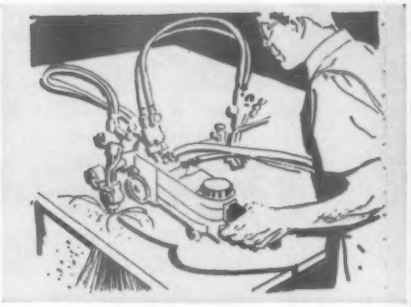

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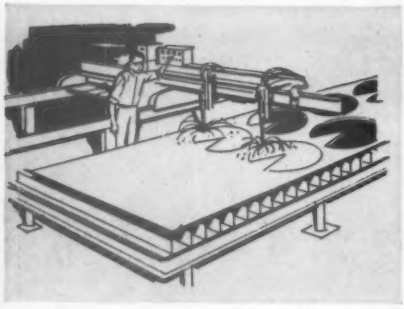
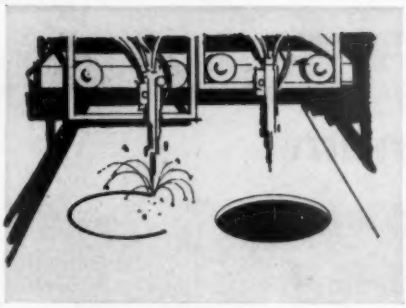
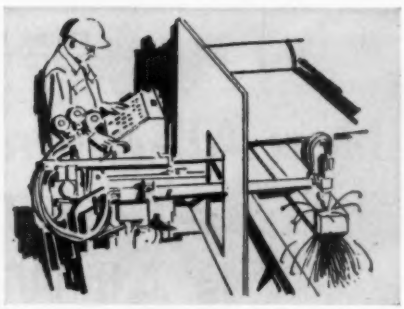


STANDARD



SPECIAL PURPOSE



STEEL MILL

Cutting Machines Pay For One Year? Two Years?

AMF estimates Messer Statosec will pay for itself in eighteen months

Yes, American Machine and Foundry has achieved results far beyond expectations from the Messer oxygen cutting machine shown here. This *Statosec* unit turns out dies (for cigar wrappers) at a rate far faster than they were formerly produced. Cost savings are such that the Messer machine can pay for itself in only 18 months—a factor that can contribute substantially to profits!

Don't Spend Money . . . Make Money! Users find that Messer oxygen cutting equipment makes money for them. For precision and accuracy, Messer machines have no equal. But more important, their use permits automated cutting operations that can greatly reduce costs and add to profits.

Shown above are representative Messer units from the largest range of standard oxygen cutting machines available from any one source. Which one can save *you* the most?

New Brochure! Write or call for a new brochure which describes Messer oxygen cutting machines and their advantages in more detail.

Messer Cutting Machines, Inc.

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WELDING ENGINEERING Messer SINCE 1898

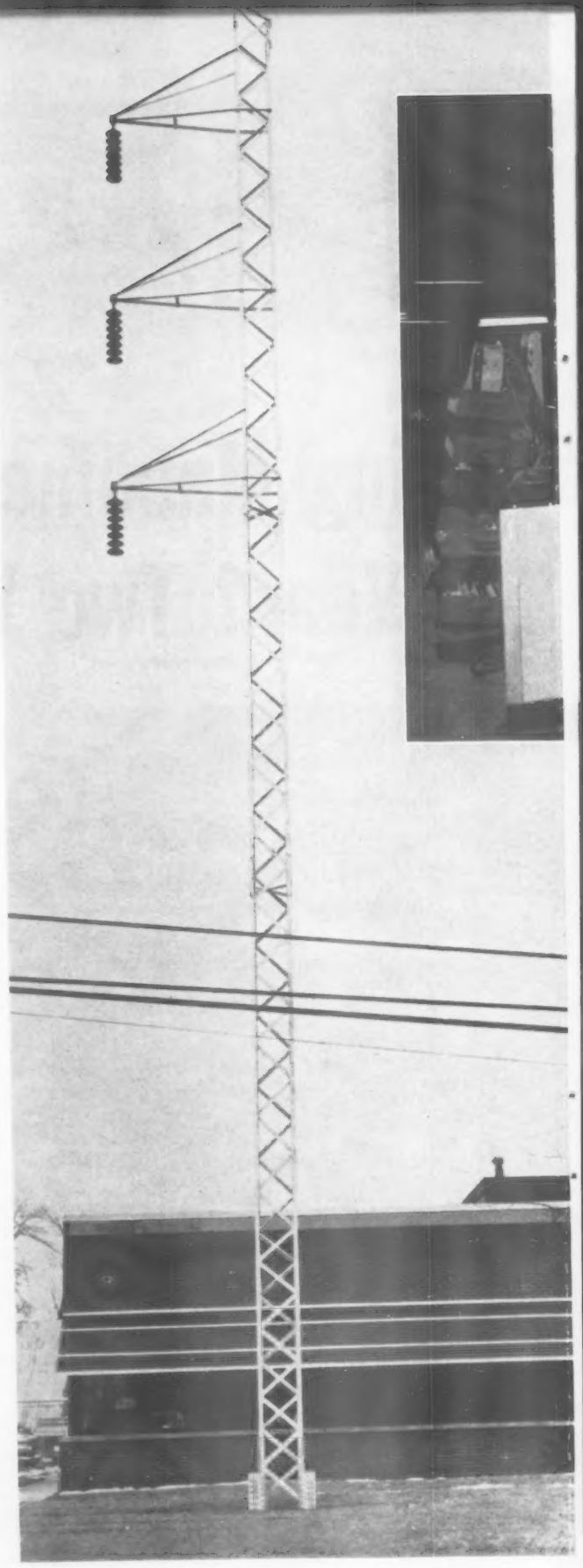
For More Information Circle No. 70 on Reader Service Card.

New All-Aluminum Truss-Type Tower Is All-Welded

IN BRIEF: Electrical transmission tower is built like a good fishpole; it is heaviest near the base where strength is needed and lightest at the top where excess weight would be undesirable.

AN ALL-ALUMINUM electrical transmission tower that exceeds standard strength requirements yet weighs only one-third as much as comparable steel towers.

That's what has been developed by the Handley-Brown Company of Jackson, Michigan. The free-standing Alrectic lattice pole, with aluminum cross arms supporting ASCR conductors, carries 69-kv transmission lines through areas where attractive appearance is needed. The pole is fabricated from 6061 T-6 heat treated aluminum extrusions from Olin Mathieson Chemical Corp.



COMPETITIVE IN COSTS

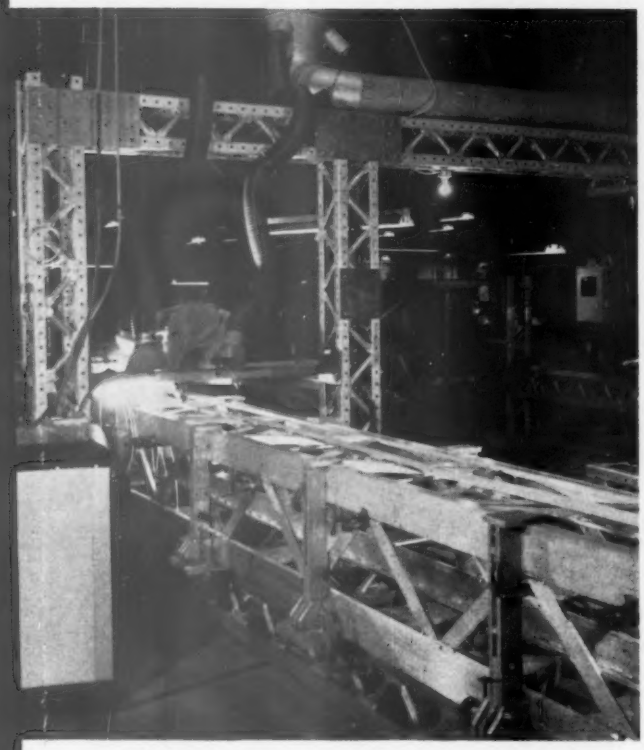
The installed cost of the new welded truss-type tower is competitive with steel structures. Its light weight makes handling easy and cuts erection time and costs. The aluminum does not rust and is highly resistant to corrosion so it will last indefinitely. And, it does not need periodic repainting.

Handley-Brown is the company that developed the successful Alrectic System of welded aluminum substation construction. Several leading utility concerns have since adopted this system, specifying its lightweight modular aluminum truss sections as standard for their substations. Alrectic structures are also used in crane booms, overhead sign and cable supports and television and microwave towers. The Alrectic lattice pole and Alrectic substations are distributed through Line Material Industries, Milwaukee.

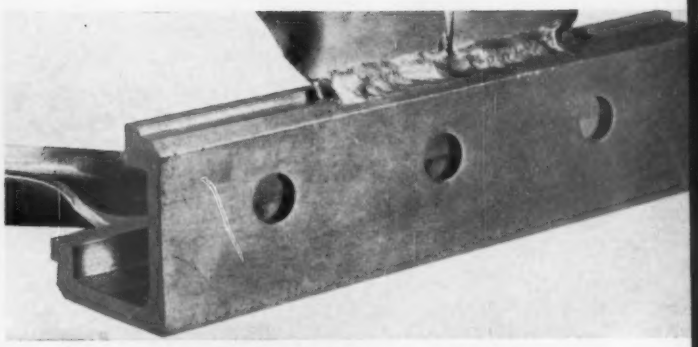
"The new lattice pole was developed along the basic Alrectic principles," says President Harold E. Handley of Handley-Brown. "Enthusiastic above the advantages of aluminum substations, electric utility engineers asked us to try incorporating the same advantages into a 69-kv transmission tower.

"Our goal was to reduce the tower weight sharply without sacrificing strength. To do this we designed special extrusion shapes for the main structural members. We just didn't substitute aluminum for steel in conventional tower construction."

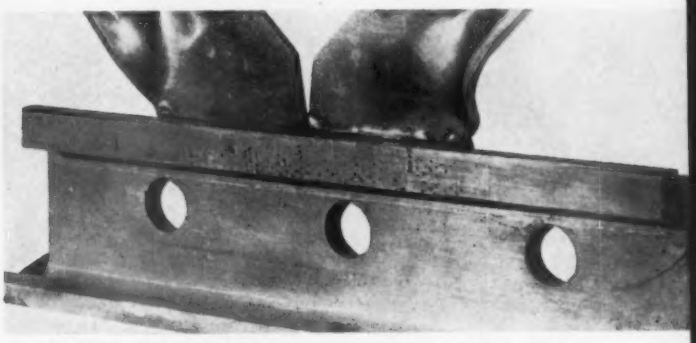
The lattice poles are 85 feet long and 24-inches square. They are truss assemblies made of specially shaped extruded corner chord angles, laced with T-channels. The complete pole, including three crossarms each nearly seven feet long, weighs 1,400 pounds.



ALUMINUM TRUSSES are assembled on special welding fixtures. Lacing is welded to chord angles as the fixture passes the welding station.



A BEAD on aluminum angles drains heat from weld and reduces the size of the heat affected zone.



WELD PENETRATES under the lacing and flows over the top of the bead resulting in a combination butt weld and lap weld.

BUILT LIKE GOOD FISHPOLES

A significant structural feature: The towers do not taper in size toward the top of the pole, but they do taper in weight. They are built like well-balanced fishpoles: heaviest near the base where strength is needed most and tapering off to the lightest chords at the top where excess weight is undesirable.

Handley gets this taper by using three different sizes of chord angles and by varying the weight and number of aluminum stiffener plates welded inside the chords. The largest chords (heavy 3- by 6-inch extrusions) rise 32 feet from the base. Spliced to these by welding are smaller 23-foot long chord angles, heavy extrusions measuring 3- by 3-inches, and atop these are spliced lighter (thinner) 3- by 3-inch chord angles that complete the job.

Since the pole is welded throughout—including all chord angle splices, lacing and cross-beam connections—the slippage that often accompanies bolted construction in conventional towers is eliminated. The only field bolting is done to connect the one-piece tower with the concrete foundation.

The towers are free-standing. Only those at corners where the transmission line ends or changes direction are guyed.

Structural tests showed the new towers could withstand loads equivalent to winds of 140 miles an hour while supporting three conductors on three crossarms plus static wire, with the poles 600 feet apart.

Under loads equivalent to 140 mph winds, the pole deflected 84 inches from the horizontal without failure of a single member or weldment. Poles virtually returned to horizontal when loads representing lateral stress were removed.

SPECIAL CHORD DESIGN

The new lattice pole (and the Alrectic System) use a specially designed extrusion shape for the chord angles at the corners of the trusses. The edges of these chord angles are enlarged with a bead that:

First, it strengthens the edge where failure usually begins in standard aluminum and steel shapes.

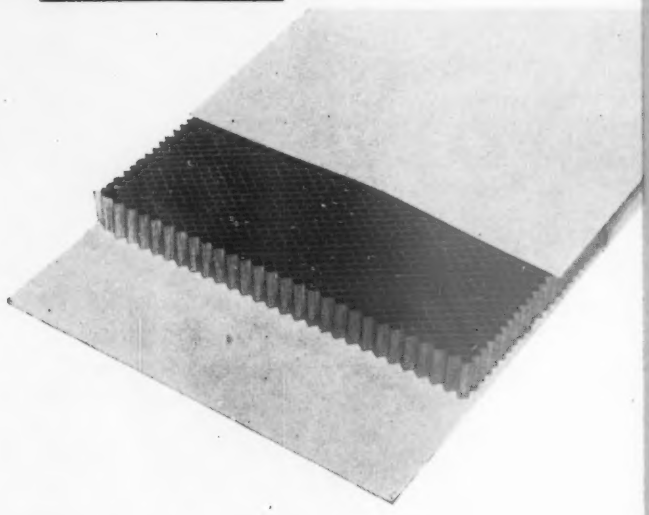
Second, it provides room on the chord angle edge for a longitudinal groove into which the lacings are welded. This makes it easier to position the lacing during welding.

Third, the groove, or track, in the bead gives an exceptionally strong weld. It is essentially a combination of butt-weld and lap-weld since the filler metal flows down the end and up the side of the lace. This eliminates the need for welding from inside the truss.

Fourth, the bead carries off welding heat and keeps the heat effected zone to a minimum. Mr. Handley said this procedure proved so effective that the resulting trusses actually are stronger in the chord angle at the weld than they are between the welds.

During welding, the weldments are checked with tensile testing machine. They must exceed by more than 10% NEMA standard strength requirements. • •

AN INDUSTRY FORECAST



Stanford Research Institute forecasts a sharp increase in the air, space, and ground use of brazed and welded sandwich materials. To meet requirements . . .

HONEYCOMB CORE AND PANEL MAKERS FACE THESE PROBLEMS . . .

. . . In Design

- Need comprehensive stress analysis and design criteria.
- Tolerences are extremely close.
- Materials change size during heat treatment.
- Thermal expansion of connecting members is different.
- Core selection

. . . In Manufacturing

- Getting the right foil thicknesses and properties.
- Consistent node-weld strength.
- Cleanliness of material before welding.
- Holding cell alignment and core thickness to close tolerences.
- Burr elimination for good sheet-core bonds.
- Manufacture of leak-proof core.

DEVELOPMENTS WILL CENTER ON . . .

1. The change in materials at high temperatures.
2. Design and application specifications for sandwich materials.
3. New and improved manufacturing techniques.
4. Techniques for joining new materials.
5. Qualification of welded structures due to strength, structural design, and fabrication limitations.

Honeycomb Production Must

IN BRIEF: With an expected 19-fold increase in honeycomb use in the next few years the welding industry is in for brisk business. Here is a well-founded report on what to expect.

"STAINLESS STEEL HONEYCOMB requirements should explode 19 times by 1963," forecasts the Stanford Research Institute.

Near the end of 1963, the need for stainless steel honeycomb should reach 885,000 board feet of panel core. A board foot, by the way, is 12 x 12 x 1 inch. A piece 10 feet long, an inch thick, and 6 inches wide contains 5 board feet. Doubling the thickness doubles the board footage, and so on. When Stanford drew their conclusions last August the requirements were 60,000 board feet a quarter. By mid-1960, the need will reach 160,000 board feet a quarter.

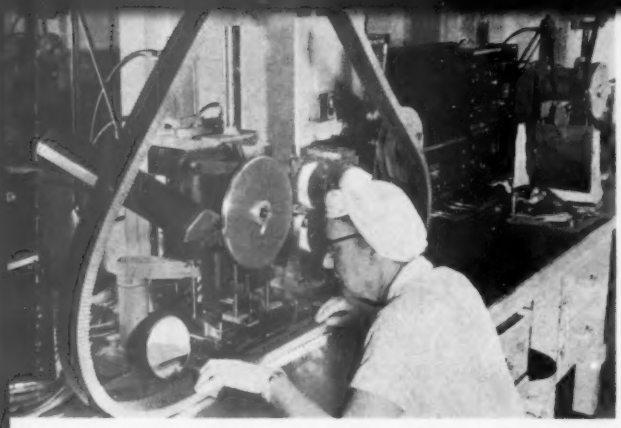
What does this mean to the welding industry?

Core is brazed or welded between face sheets of stainless steel to make a sandwich or panel. Right now, it is all done by brazing; in five years there will be a big increase in welded honeycomb panels. Keep both processes in mind. And, remember the 885,000 board foot figure. This means the manufacturers of welding and brazing equipment, materials and accessories, as well as the metal producers, are in for a big increase in business. Honeycomb core and panel makers will need huge volumes of gases for protective atmospheres, tons of brazing filler metals, many brazing furnaces and fixtures. The field will be open for making and selling new automatic core-making machines. And panel makers will need machines to shear, nibble, punch, form, shape, and shave. They'll need the best nondestructive testing equipment, and they'll gobble up improvements to get a better product and lower costs.

Right now, they inspect sandwich materials nondestructively by radiography, thermal flash, fluoroscopy, ultrasonics, and themography. Radiography and thermal flash are used most, but the others show great promise for more use.

MANY APPLICATIONS BESIDES AIRCRAFT

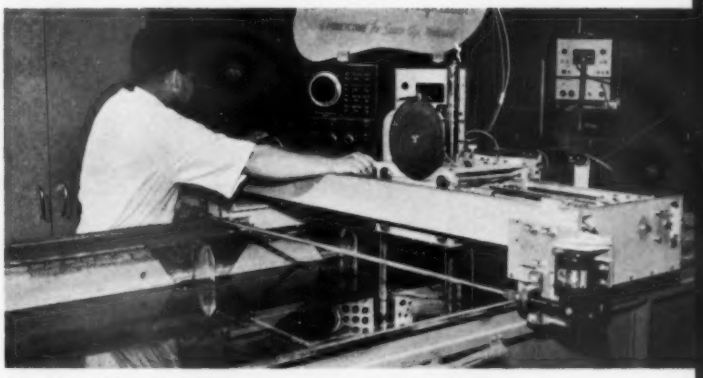
It doesn't stop there. The SRI forecast covers only core for missile and airplane airframes. Besides things



CONTINUOUS BELT core welding machine is simple, flexible, and inexpensive; cell-size changes are quick.

CONTOURED STRUCTURAL SHAPES are machined at Martin Co. with a stylus-following Hula-Head cutter.

PANEL BRAZING FURNACES are being improved to provide faster heating and cooling and better zone control.



SOLAR INSPECTS honeycomb panel quality with ultrasonics, one of the most promising inspection methods.

Increase 1,900 Percent By 1963

that fly, there are things that don't, like nuclear reactor structures, heat exchangers, acoustical insulation, high and low temperature insulation, pressurized tanks, and liquid-storage tanks. Add the equipment and materials needed to braze, weld, shape, an inspect these promising jobs and the figures become boxcar.

What steels will be used for these sandwiches? The logical choice is stainless and other high alloy steels because of their high strenght-to-weight ratios and their ability to resist high temperatures. According to the SRI forecast, most cores will be of PH 15-7 Mo CRES stainless steel. A smaller amount of core will be of 17-7 PH CRES stainless steel. Core has been made from T-310, T-321, T-347, Inconel-,X Haynes 25, AM-350, AM 355, 19-9DX, 19-9DL, Ti-75A, Ti-100A, Ti-6AL-4V A-286, Hastelloy X, Rene 41, M 242, Hastelloy R-235, titanium alloy, B-120VCA, Inconel 702, molybdenum, tantalum, and columbium.

For air vehicles, the sandwich and the material will depend on loads and environment. Designers will apply honeycomb, corrugated, or waffle cores where they will do the best job. No one core design will be universally applied.

The report forecasts that in the next few years there will be a sizeable increase in the production of brazed honeycomb panels, and a corresponding decrease in the production of adhesive-bonded panels. Then there's the interest in welded sandwich panels. The interest isn't a passing one; these panels have distinct advantages.

WELDED PANELS HAVE LESS LIMITS

For instance, the only limit to using a welded panel at high temperatures is the parent metal. The brazing alloy in a brazed panel limits the heat it can withstand. Another advantage of welding is that manufacturing costs are likely to be lower. The only restriction to the use of all-welded panels is limited fatigue strength at sonic speeds.

The panel face sheets are getting their share of attention, too. Completely automatic butt welding of sheets of stainless is coming closer every day. They must be joined to meet aircraft and missile needs.

turn to page 90

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HONEYCOMB FORECAST

continued from page 89

(See "Convair Butt Welds .002-inch Stainless Steel" WD&F, February, 1960, p. 34.)

The machine for automated welding of foil sheets already exists. There is a welding fixture on the market that can butt weld 0.005-inch stainless. When the machines are automated one operator will be able to run a bank of them. He simply keeps them loaded with foil blanks. An electronic tape control will direct the machines to feed sheets into the welding fixture, position and clamp them, make the weld, then remove and stack the finished sheets.

PREFORMED WELDED CORE IS BEST

There are two kinds of welded core: preformed and expanded. The quality of the preformed is best. It is made by the continuous belt process or the blanket process. The continuous belt machine is simple, flexible and inexpensive. The blanket machine is potentially a fully automatic, high production machine. Its drawback is the excessive time needed to change from one cell size to another. Also, the blanket machine is expensive. It costs about 10 times more than the belt machine.

Semiautomatics bring the price of core to about $30 a board foot. In another five years SRI expects the price to drop to $10.

A square foot of flat brazed panel costs about $175. By 1965, this price may be $65.

Of the various methods used for brazing metal sandwiches, furnace brazing is still considered the best. There are box, carloading, bottom load, and pit furnaces, gas or electrically heated. The latest brazing furnace is the luminous wall-type. It has the advantage of high heat, rapid heating and cooling, and accurate zone control.

PROMISING BRAZING DEVELOPMENT

A very promising development in panel brazing described in the SRI report, is the use of banks of quartz lamps. With this method, temperature control is precise, heating and cooling rapid, distortion minimum, cycle time short. According to the report, costs, with the quartz lamp process are lower than with any other brazing technique. • •

Tempil Offers Guide To Ferrous Metallurgy

NEW YORK CITY: Tempil Corporation has made up its "Basic Guide to Ferrous Metallurgy" as a heavily plastic laminated rigid plaque. The guide incorporates the carbon-iron diagram and shows the important working zones in black and colors. The change in grain with temperature is schematically illustrated on one side of the chart; 24 metallurgical terms are defined on the other.

Charts cost $5.00 and are available from Tempil Corporation at 132 West 22nd Street, New York 11, N. Y.

Hobarts Offers 5-Day Welding Course

TROY, OHIO: An intensive one-week 5-day welding refresher course for public school teachers is being offered by Hobart Brothers Co., according to Howard B. Cary, director of Hobart's Technical School. Six of these courses will be offered during selected weeks of June, July and August to vocational, vocational-agricultural and industrial arts teachers.

Write to Mr. Cary at Troy, Ohio, for complete details.

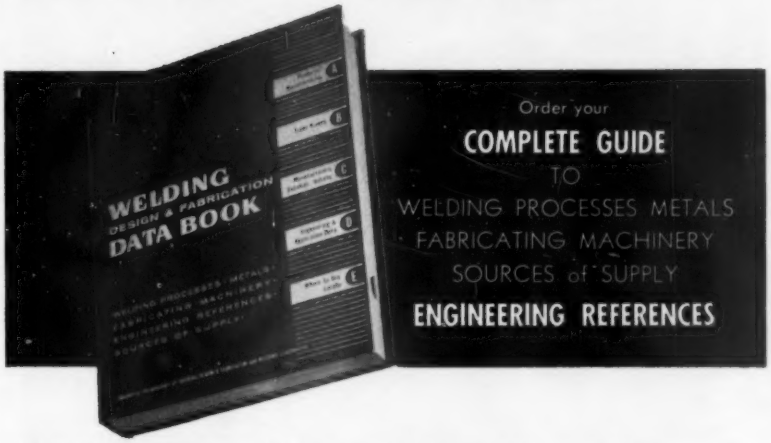
IAA Convenes In San Francisco

SAN FRANCISCO: The International Acetylene Association will hold its annual convention here at the Hotel St. Francis on Monday and Tuesday, May 9-10. Highlights of the convention include the presentation of the Morehead Medal and a three-part technical session.

KSM Products Builds New Plant

MERCHANTVILLE, N. J.; K S M Products, Inc., manufacturers of stud welding fasteners, equipment and accessories, have broken ground for new plant and office facilities to be located on a 12 acre tract in Mooretown, New Jersey.

931 PAGES OF VALUABLE WELDING INFORMATION



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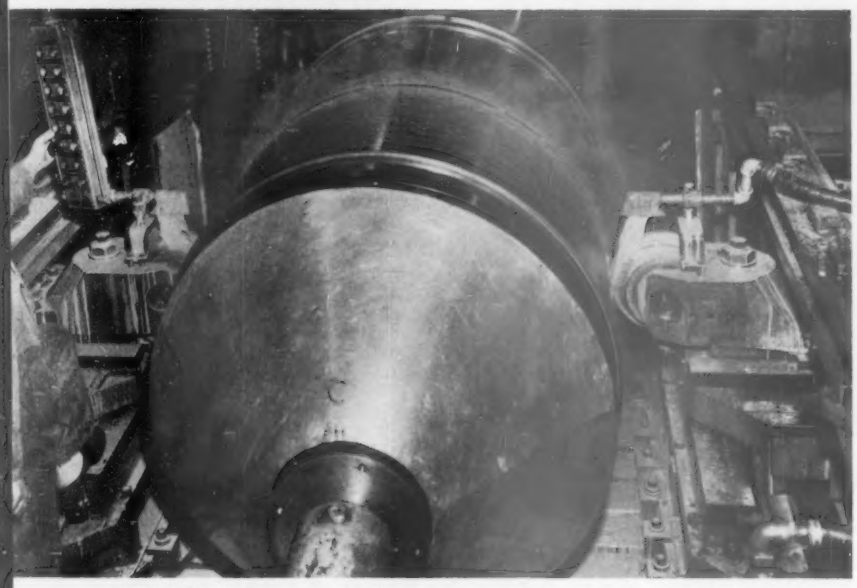


ROLL FORMING turns out a shell for a 54-inch diameter solid fuel rocket motor case.

FORMED section is checked visually.

Roll Forming And Welding

by **R. H. GADE**, *chief production engineer, Kaiser Fleetwings, Inc.*

IN BRIEF: Roll forming, a relatively new fabricating process, helps this company turn out quality welded missile body shells.

KAISER FLEETWINGS, INC., at the Bristol, Pennsylvania, facility is fabricating production rocket motor cases utilizing roll formed body shells. Sizes ranging from 14 inches diameter to 54 inches diameter and up to 78 inches long, with finished wall thickness ranges from .065 inches to .181 inches have been produced by roll forming within tolerances of plus or minus .004 inches.

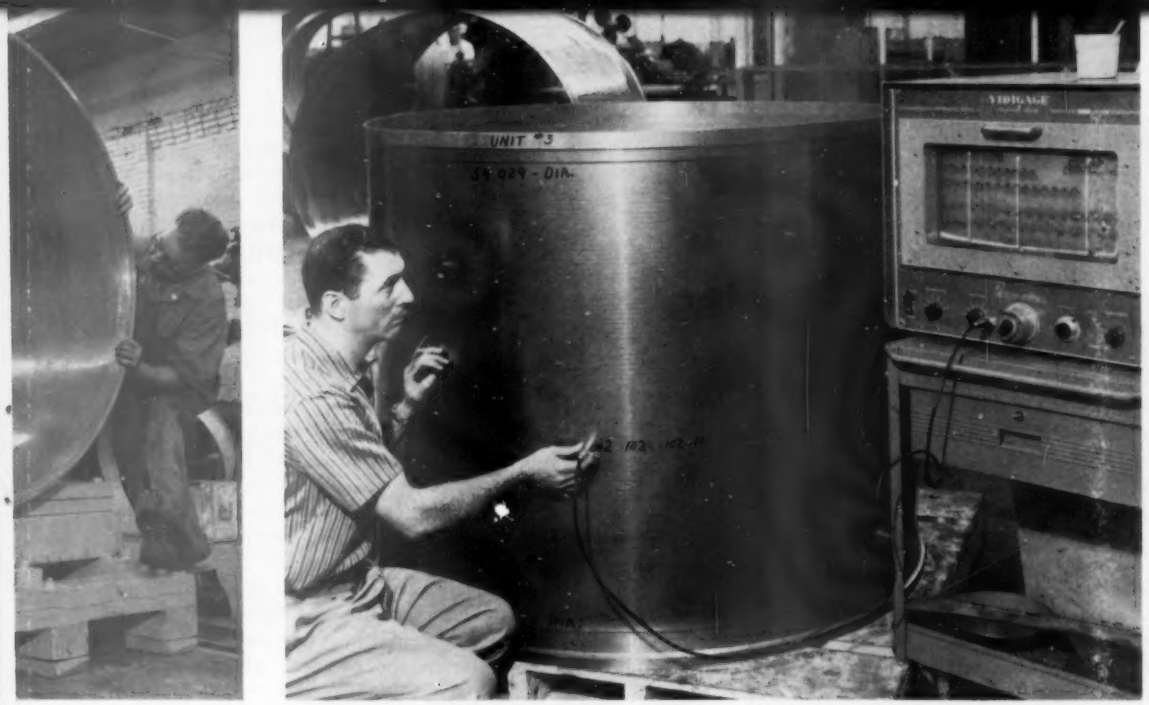
The roll forming process permits the use of heavier walled short cylindrical blanks, either machined ring forgings or wrapped and longitudinally welded cylinders of sheet material. Factors in the selection of the type of blank is cost, plus the ability to get sufficiently clean or inclusion free steel sheet in the selected alloy.

The blank is reduced in wall thickness 50% to 65%, sized to the forming mandrel, and increased in length 2 to 2¾ times. The forming rolls apply a unit pressure greater than the yield strength of the steel, and as the mandrel mounted blank rotates, the free turning forming rolls traverse under controlled feed rate parallel to the mandrel center line. The finished shell extrudes back, opposite in direction to the forming roll travel.

Low alloy, medium carbon steels are roll formed in the spheroidize anneal condition. Consistent results are obtained when the spheroidization is not less than 80 to 85 percent, as determined by metallurgical examination. Care must be exercised to insure a surface free from carburization. A slight decarburization appears to be beneficial, and insures that no local areas of carburization exist.

The roll formed welded blanks exhibit a beneficial wroughting and homogenization of the weld area. No failures of hydrostatically tested motor cases have occurred in roll formed shells made from welded

ABOUT THE AUTHOR: *Mr. Gade has had 18 years experience in structural design and development; fifteen of these were related to aircraft design and manufacture at Kaiser Fleetwings, Inc. He has had broad experience in structural design and analysis, testing and project management. These projects included prime design responsibility on varied aircraft types such as spot welded stainless steel designs, plywood monocoque designs and aluminum alloy aircraft. In his present position Mr. Gade is responsible for engineer functions related to his company's activity in the missile and rocket component field. He holds a B.S.C.E. degree from the University of Illinois. He has done post-graduate work at M.I.T., Princeton and Penn State.*



ULTRASONIC INSPECTION equipment is used to measure wall thicknesses.

Make Better Missile Body Shells

blanks or forged blanks as contrast with the reported number of failures originating in the longitudinal weld of fabricated shells. Needless to say, roll forming will not heal improper welding. Prior to roll forming, welds are subjected to 100% radiographic examination and magnetic particle inspection and certified as defect free.

A further advantages of roll formed welded shells is weight control. Mill tolerance variations in sheet material are plus or minus 10 percent in the gages presently called for in motor case shells. Roll forming tolerances reduce this variation to 4 percent, and roll forming further eliminates a design allowance for "weld strength reduction," usually taken as 85-90%. The weight reduction becomes significant when the design allowance factor need not be considered for a longitudinal weld joint; tensile tests of coupons taken transverse to the roll formed weld area from full scale heat treated shells show mechanical properties equal to the base metal.

Welding is performed by means of an automatic TIG (tungsten-inert gas) process for both hydrospin blank preparation and final assembly of the motor case. The automatic control maintains the preselected welding schedule including travel speed, arc voltage, filler wire feed ratio, amperage and oscillation.

OSCILLATE WELDING HEAD

Oscillation of the welding head during the welding process is a major element of the welding schedule and represents a Kaiser Fleetwings development resulting in improved weld quality and reliability. The welding head is oscillated sinusoidally through an arc transverse to the weld joint center line, carrying the weld puddle, filler wire, and tungsten arc from edge to edge of the weld joint. This allows the use of lower arc voltage and amperage than would be required without oscillation and reduces the number of weld passes where multiple passes are required. The motion is similar to a hand welding weave and results in good base metal dilution and maximum shouldering and knuckling along the weld joint edges.

The rate and scope of oscillation is set to a prescribed number of cycles and width as indicated by weld schedule development. The oscillation of the welding head, being in a plane parallel to the weld surface, does not disturb the arc voltage correction circuit.

A VARIETY OF STEELS

Body shells have been produced from SAE 4130, SAE 4340, AMS 6434, modified AMS 6434, USS X-200 and Ladish D6AC steels. A preference has been indicated for consumable electrode vacuum melted steels as having a more consistent level of cleanliness and uniformity. However, air melted steels have been successfully used. The roll forming process tends to be self-inspecting in that material defects detrimental in a finished motor case usually cause a

ROLL FORMING AND WELDING

continued from page 93

surface rupture during roll forming operation. The appearance of a surface rupture is sufficient indication to suspect the cleanliness of the entire heat or the existence of surface carburization.

Incorrect feeds and excessive reductions may produce a visually acceptable part, but upon microscopic examination it is evident that internal fracturing has occurred. Also, on ductile stainless steels, the surface may appear highly burnished, but examination reveals that surface ruptures have been "smeared over." At Kaiser Fleetwings, the Metallurgical Laboratory is called upon to verify the soundness of roll forming techniques and processes.

Shear forming is also employed in producing missile chamber components. Instead of extruding the material back under the forming rolls, it is displaced in shear at the forming roll and laid down on the mandrel. A template following tracer control programs the forming rolls.

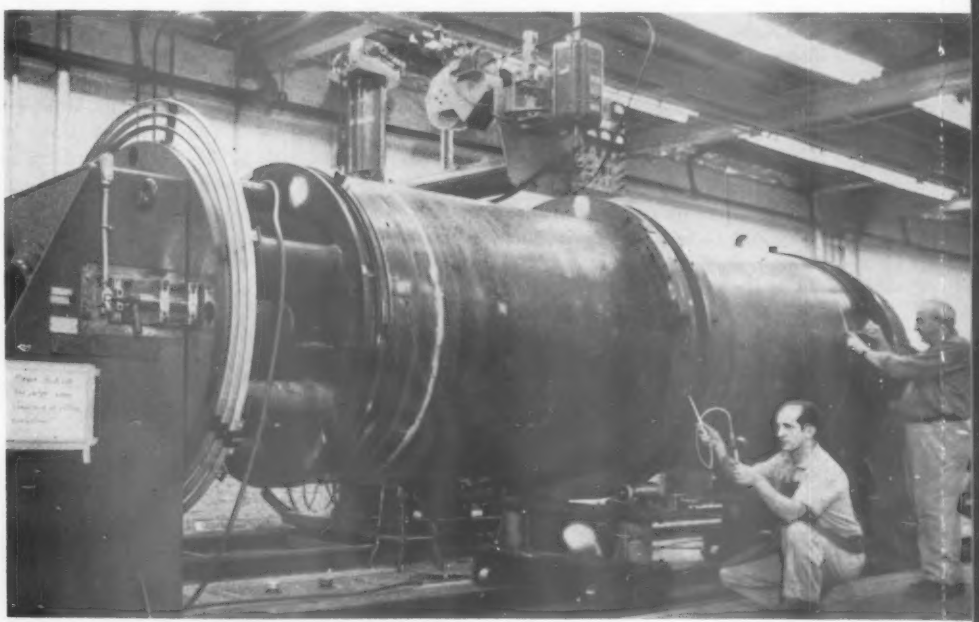
Symmetrical bodies of revolution of conical-ogival sections are being produced from 17-7 PH stainless steel. These parts, 35 inches in diameter, replace a fabricated weldment made from two deep drawn details and a developed conical weldment. A locally thickened and offset wall is provided for final assembly weld reinforcement, which was not possible to obtain in the drawn detail. The one piece shear formed components are used as pressure vessel heads for a liquid rocket motor system.

Elliptical shear formed motor case heads of 54 inch diameter have been made from the modified AMS 6434 and USS X-200 steels in limited quantities. At the present stage of development, it is found to be more economical to form these parts by a drawing process. However, with further development work and advances in the basic shear forming equipment there is optimism that this process will prove advantageous in producing controlled tolerance and variable wall thickness elliptical and spherical shapes in this size and larger.

Kaiser Fleetwings uses horizontal spindle hydrospin equipment of 60 inch swing. While this equipment has been utilized to roll form 54 inch motor case shells up to 78 inches long, and has demonstrated the utility of the roll forming method for production of rocket motor cases, it is considered that requirements for larger size components can be better met with vertical spindle machines.

An area of interest is the roll forming of beta titanium weldments. The relatively new beta titanium alloy offers a high strength-to-weight ratio as compared to presently available steels. However, the embrittlement of welds in this metal during simple or duplex aging is detrimental in motor case use. Welding after aging lowers the potential strength of the weld area to about 125 k.s.i. (equal to 200 k.s.i. in steel on an equivalent weight basis). Tests indicate that welds in beta titanium roll formed to a 40% reduction have aging characteristics similar to the base metal. Consequently, a welded, roll formed, and aged sequence of processing a beta titanium motor case shell may offer a significant advance in strength-to-weight ratio.

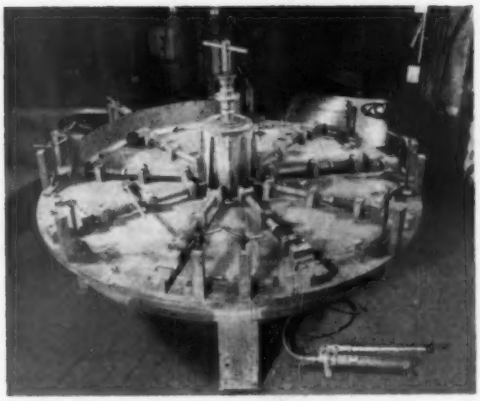
Roll forming is a relatively new fabricating process and is referred to under various trade names; such as, Hydrospin, Flo-turn, Spin Forge. The tendency is to put new process equipment to work by trial and error application. This may be successful for specific application. However, to effect the fullest utilization of the roll forming and shear forming process, basic concepts of the metal flow must be adhered to. • •



OSCILLATING welding head is an important feature in automatic tungsten arc-inert gas shielded welding of roll formed shells.

for straightening and positioning

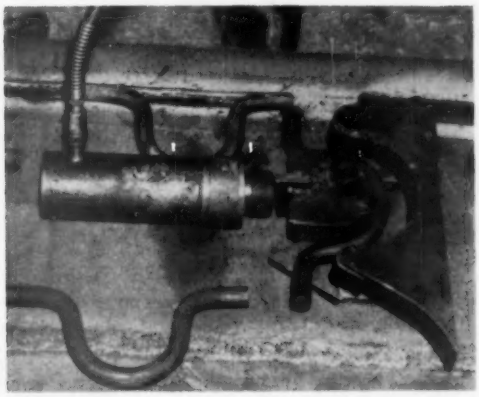
DISTORTION is removed from conveyor section weldment using 50-ton ram and electrically-driven pump. It's faster than heating and hammering and it's cheaper than a standard press with a higher burden rate.



FORMED SEGMENTS of special metal drum are positioned and clamped for welding. Clamping arms are expanded by a cone in the central column of the fixture. A 10-ton ram and hand pump actuate the cone.

for bending and forming

BENDING two-inch pipe with special bending attachment is faster, easier and more accurate than heating and hammering.



FORMING loops and hooks from one-inch bars is typical short run operation. Longer runs are moved to a standard press brake.

Tooling For Short Run Production Welding

IN BRIEF: Remote-controlled hydraulic jacks are used when short run production rules out standard equipment.

TOOLING FOR WELDING is a trial to fabricators with short production runs. Should they try to get by with no tooling at all? Or, do they have to invest in specialized tooling with a high burden rate?

One economical alternative to these extremes seems to be remotely-controlled hydraulic jacks, like those made by Blackhawk Mfg. Co.

These Porto-Power jacks are not ordinary hydraulic jacks. They're remotely controlled. Their pumps (hand or electrically-operated) are separated from the ram by a long flexible hose. The jacks will exert 2 to 50 tons in any direction and at any angle. And, they do more than lift. When ingenuous attachments are threaded onto the ram, the jacks can be used to push, pull, lift, press, bend, spread and clamp.

This versatility keeps fabricators three ways:

- Jacks are used before welding. They form and bend components. They're ideal when limited production rules out use of standard presses or benders.
- They're used during welding for fitting up, clamping and positioning.
- They're used to correct distortion after welding. stress relieving or other heat treating.

Fabricators list two other big advantages: Jacks are flexible (several jobs can be done with a single unit) and they reduce handling time (men can take the tool to the work). • •

WD&F Appoints Editorial Advisory Board

IN ITS EARLY DAYS welding was mostly a repair and maintenance tool. Its use for this purpose grew tremendously over the years. However, during these same years welding's use as a production process grew much more rapidly and today is the dominant part of the market. How fast has it grown? The welding industry consumed 30,000 pounds of electrodes in 1930; during 1959 it used approximately 550,000,000 pounds.

Today, welding's most important task is making more welded fabrications, structures, and products. And, it is in these areas that the welding industry's big future growth lies.

Obviously, the welding industry's job is to increase the number of economical welded fabrications, structures, and products. Welding's early growth was at the expense of products that could be easily converted to welding. However, growth today and in the future is more difficult because conversion has become more complicated.

To stimulate this growth the welding industry must understand fully the three interdependent functions common to all welded products: welded design, welding methods, and fabrication procedures. In the first place we must make sure products are designed for welding. Second, we must reduce welding costs because welding usually amounts to 50 percent or more of a fabrication's total labor cost. Finally, we must make sure fabricating techniques are not the weak link in the chain of producing economical weldments.

Because we are aware of this situation, we have broadened the editorial scope of WELDING DESIGN & FABRICATION over the last two years to cover in detail design, welding methods, and fabricating techniques. But, welding's use and design requirements have broadened so much that no one man can keep pace with its growth and application in all fields. Since last July, we have been working with a unique editorial advisory board made up of industry leaders—men who have championed the cause of welding and welded design. These men will team up with our large, permanent editorial staff in its pioneering efforts that include broadened editorial coverage and added circulation to design engineering people.

We are now introducing this advisory board and are giving its members credit for helping us. Naturally, this board will not be static. It will expand as the need arises. Meetings and consultations have been held and regular meetings have been scheduled.

The 38,0000 readers of this magazine should benefit from the welding experience of the members of this board. With the challenge for expansion facing the welding industry today, our regular staff and this advisory board will team up to bring our readers creative and practical articles which will help readers cut the cost of welding and extend its use.●●

● Arsham Amirikian, consulting engineer
● Chevy Chase, Maryland

Mr. Amirikian's career as been devoted to developing improved design and analysis methods and devising better construction procedures and techniques. This includes pioneering efforts in the welded design of unusual rigid-frame buildings, large span arch-frame hangars, and huge drydock gates and floating docks. Some of these represent the first and largest all-welded structures of their types. Others are recognized innovations in structural framings.

A graduate of Cornell's School of Engineering with a degree in Civil Engineering, Mr. Amirikian entered the government service in 1928 as assistant structural engineer in the Navy's Bureau of Yards and Docks. He has remained with that organization to date, advancing through various grades to chief design engineer and special structures consultant.

The author of a design treatise entitled "Analysis of Rigid Frames," Mr. Amirikian has written 50 articles and papers for technical periodicals.

● C. D. Jensen, research and testing director
● Pennsylvania Dept. of Highways, Harrisburg

Prof. Jensen is professor of civil engineering at Lehigh University and is serving in his present position during a leave of absence.

Prof. Jensen had four years of experience in highway location, hydro-electric and property surveys before joining Lehigh in 1925.

During World War II, he did welding research for the U. S. Naval Engineering Experiment Station at Annapolis from 1942 to 1946. There, he developed underwater cutting and welding techniques and did stress investigations on welded propeller shafts and other weldments. During this time he obtained a patent for a coated underwater cutting electrode.

Prof. Jensen has published many research papers and recently directed a research project on welded interior beam-column connections for the American Institute of Steel Construction.

Prof. Jensen is a professional engineer in Pennsylvania.

● Louis J. Larson, consulting engineer
● Allis Chalmers Mfg. Co., Milwaukee

Mr. Larson holds engineering degrees from the University of Minnesota and the University of Illinois. He taught at Illinois from 1920 to 1926. In 1927 he joined A. O. Smith Corp., Milwaukee, where he served as research engineer and director of welding research until 1938. In 1942, after several years as consulting engineer to major Milwaukee area companies, Mr. Larson joined the Industries Group, Allis Chalmers, as welding consultant. Since 1949 he has also

served as welding consultant for the Argonne National Laboratory.

During World War II, Mr. Larson planned and directed welding of equipment for the Oak Ridge Manhattan Project and developed welding procedures for Navy gas and steam turbine components.

Mr. Larson is a professional engineer in the state of Wisconsin. He has written numerous technical articles and has been issued a number of patents.

- **Roy B. McCauley, assistant professor and chairman Dept. of Welding Engineering**
- Ohio State University, Columbus, Ohio

Prof. McCauley is widely known as an educator, consultant, author, and lecturer.

As an educator, he is chairman of the Department of Welding Engineering at Ohio State University, one of the few universities that offers a degree in Welding Engineering. He has been at Ohio State since 1950. Prior to that he taught at the Illinois Institute of Technology for 10 years.

As a consultant, Prof. McCauley is active in several phases of radiography and metallurgy. He is a professional engineer in the state of Illinois and is a licensed radioisotope radiographer.

As an author, Prof. McCauley's activities are almost too numerous to mention. He has written numerous papers for technical journals and has contributed to various handbooks, including those of the ASM, SNT, and ASTE.

As a lecturer, Prof. McCauley has spoken at meetings of the American Welding Society and other technical groups.

- **Loren C. Miller, works manager, steel fabricating division**
- Austin Company, Cleveland, Ohio

Mr. Miller graduated from Case Institute of Technology in 1949 with a BS degree in Civil Engineering. He then joined Austin as structural draftsman in the Steel Fabricating Division. In 1952 he became structural engineer with responsibility for the design of structural steel in industrial buildings.

He was made assistant works manager of the Steel Fabricating Division in December, 1952, and works manager in 1953. In addition to the management of the Division, Mr. Miller is in charge of all engineering and design in that Division, including the reviewing of structural designs. He is consultant on welded designs for Austin's various engineering departments.

Mr. Miller is registered to practice engineering in 17 states.

- **John Mikulak, assistant to the vice president of manufacturing**
- Worthington Corp., Plainfield, N. J.

Mr. Mikulak is responsible for handling welding and fabrication problems. And, as consultant for the corporation's manufacturing problems, he supervises Worthington's Manufacturing Laboratory.

A graduate of the University of Minnesota, Mr. Mikulak joined the Electric Machinery Mfg. Co. in Minneapolis. He was in charge of welding operations when this firm became a subsidiary of Worthington in 1943.

From 1945 to 1951 (when he rejoined Worthington) Mr. Mikulak was at American Car and Foundry Co. He was Chief Engineer of Welded Products Division and later senior research engineer.

Mr. Mikulak is a profesional engineer, practicing in the state of New Jersey.

- **J. B. Austin, manager-welding division**
- Republic Structural Iron Works, Cleveland

Mr. Austin has been with Republic Structural Iron Works since 1938 when he joined the firm as a welding engineer. Prior to that he had served as research engineer and director of research at other welding companies.

Well known as an author, Mr. Austin has written one book ("Electric Arc Welding") and collaborated with Professor Harry D. Churchill of Case Institute of Technology on another ("Weld Design").

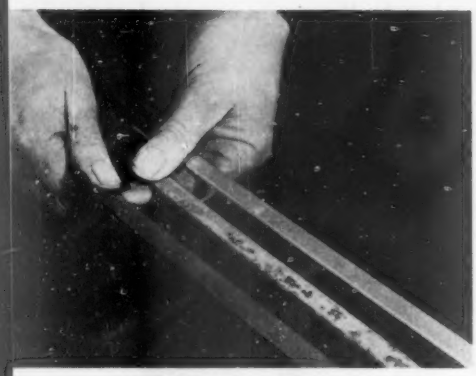
A past chairman of the Cleveland Section of the American Welding Society, Mr. Austin is a registered mechanical engineer in the state of Ohio.

- **R. E. Robison, chief designer**
- Howard, Needles, Tammen & Bergendoff consulting engineers

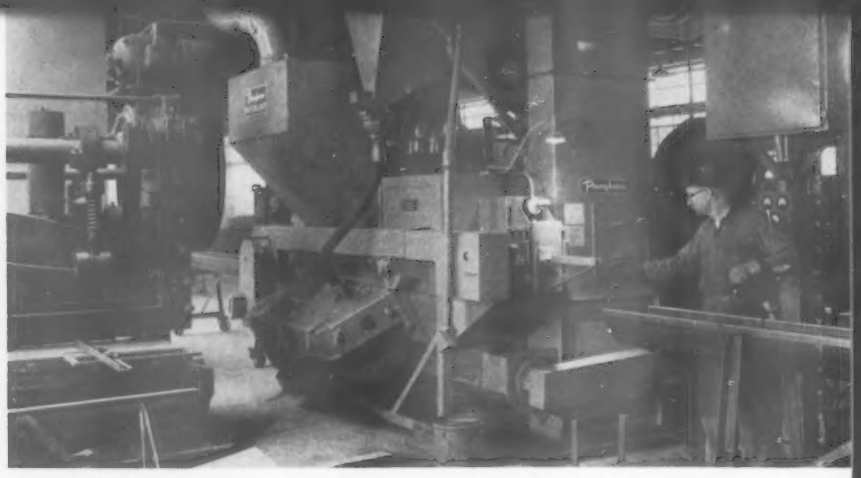
Mr. Robison has extensive experience in designing bridges. He has helped design a number of major and minor highway and railway bridges, including a number of all-welded structures.

Mr. Robison received his BS in Civil Engineering from the University of Illinois in 1945. He then served in the Civil Engineering Corps of the U. S. Navy, returning to Illinois to get his MS in 1947. He joined Howard, Needles, Tammen and Bergendoff in 1957, becoming chief designer in the firm's Cleveland Office in 1956.

Mr. Robison is a registered engineer.



COMPARISON of hot rolled steel bars: mill scale (left), pickled and oiled just before use (center), descaled.



HOT ROLLED STEEL BARS are fed into this blast descaling machine at speeds up to 180 linear feet per minute just before serrating, forming and welding operations. Operation could be made completely automatic if and when production warrants it.

Descaling Before Welding Saves $75 A Day

IN BRIEF: Mechanical descaling eliminates insulating rust and scale from hot rolled steel bars so automatic resistance welder can make better welds with less heat.

PRODUCTION of non-skid industrial safety grating at Bustin Steel Products, Inc., Dover, N.J., starts with mechanical descaling of hot rolled steel bars. This operation saves at least $75 a day.

Leo Bustin, president, developed the first automatic process for making this kind of grating. He invented a fabricating and resistance welding machine. It automatically does the work of 24 operators—and does it better.

Eliminates Spatter Grinding After Welding

YORK'S *SPAT-R-PRUF* COMPOUND 106

THREE *EASY* STEPS

1. Coat Surface
2. Weld
3. Wipe Off

A perfect paint base. No stirring or dilution necessary. No grinding after welding—spatter can be wiped away with a dry cloth.

IMPORTANT FEATURES

- Non Toxic
- Non Inflammable
- Pleasing Odor
- Harmless to Skin
- Helps Prevent Rust
- No Weld Porosity

Available in 1 gallon cans and 5 gallon cans and 55 gallon drums.

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YORK'S '77'
SPECIAL FLUX

- For General Brazing
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A guaranteed bond even under toughest conditions.
Available: 1 lb. Cans

YORK ENGINEERING COMPANY
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For More Information Circle No. 100 on Reader Service Card.

PLASTIC WELDING

VALUABLE NEW DATA

During the last few years gas welding of plastics has been applied with particular success to a large and ever-increasing variety of constructions where it has proved invaluable. Information on this subject is rather scarce. This manual will be extremely valuable to practical welding people and to engineers who intend to incorporate plastic materials into their designs.

PRICE $6.00

WELDING DESIGN & FABRICATION
812 HURON ROAD
CLEVELAND 15, OHIO

DESCALED BARS end up as non-skid industrial safety grating after serrating, forming and welding.

The special machine is big: 40-feet long, 22-feet wide and 11-feet high. But it's a precise and delicate thing. It could not work properly with scaly or rusted material.

That where descaling comes in. The only alternative would be to start out with pickled bar stock. But, it costs more and must be oiled or it rusts, and sometimes it rusts anyway. Besides, to get the oil would take expensive degreasing. It's hard to make good welds in oily stock.

Mechanical descaling is a regular part of the process. It's done only seconds before serrating, forming and welding. The bars, descaled down to bare metal, can be serrated at high speed without using oil to protect special tools. The tools and dies last longer. And, descaled bars weld better with less heat.

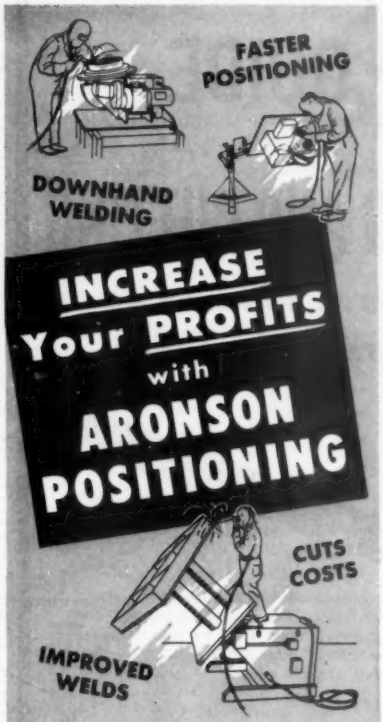
Bustin's mechanical descaler is a three-wheel Rotoblast machine made by Pangborn Mfg. Corp. The machine can hurl 52 tons of steel abrasive shot an hour. It blasts all surfaces of the bar stock in one pass at 180 linear feet a minute. That's 80,000 linear feet in an 8-hour shift. This capacity provides enough bar stock to make 10,000 square feet of grating every shift.

Bustin buys hot rolled bar stock in cut lengths almost 11-feet long. It ranges from 3/8-to 2½-inch wide and from 0.104- to 3/16-inch thick.

Powered pinch rolls drive the bars through the descaling machine.

A single operator runs the descaler.

While exact savings are not yet known, Mr. Bustin says his company saves at least the difference between its daily descaling cost (about $50) and daily pickling costs ($125). • •



UNIVERSAL BALANCE® POSITIONERS
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GEAR DRIVEN POSITIONERS
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TRACTRED® TURNING ROLLS
TURNTABLES
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MAGNETIC WELDING CLAMPS

Aronson MACHINE COMPANY
ARCADE, NEW YORK

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SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

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and other RWMA classes of alloys to fit your needs.

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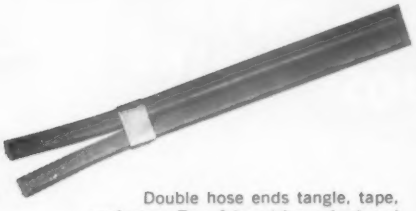
Oxweld GUIDE

TO BETTER WELDING AND CUTTING

Six popular accessories... and why so many experienced welders prefer them...

Large vented nylon cups fit comfortably over prescription glasses. No. 24 Goggles lift with one hand because the bridge is rigid. Standard AA green lenses. 3 shades.

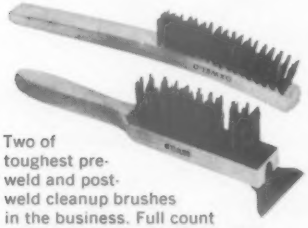


Double hose ends tangle, tape, confusion. Two 1-braid lines (red and green) molded side by side for easy handling. Tough but flexible connecting web, smooth cover.

Eliminate clogged tips with OXWELD Tip Cleaners. Remove oxides and carbon deposits without damaging accurately dimensioned ports. Master set cleans 46 drill sizes.

OXWELD Welding Gloves are luxuriously soft, yet tough and long-wearing. Long gauntlet protects wrists and forearms. Suede leather, flame-resistant fabric, or combination.

OXWELD Lighter provides fat, sure-fire spark every time, because flint strikes file at an angle. Self-cleaning file turns automatically, will not clog or fill up.



Two of toughest pre-weld and post-weld cleanup brushes in the business. Full count of firmly anchored wires. Scraper makes short work of dirt, flux residue, and spatter removal.

Call your LINDE Distributor for prompt service on any welding or cutting need. Or write for his name and address to: Dept. 510, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N.Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

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Linde UNION CARBIDE

For More Information Circle No. 60 on Reader Service Card.

REFERENCE DATA

A COLORFUL WALL CHART that contains data on resistance welding specifications, welding schedules and electrodes and accessories is available from Ampco Metal, Inc. Data Chart RW-5 is a stain-resistant 20½- by 29½-inch metal-edged chart.

Circle No. 300 on Reader Service Card.

A WET ABRASIVE CUTTING machine is the subject of 4-page folder, Bulletin DH-260-R, issued by Allison-Campbell Division, American Chain & Cable Co., Inc. Described in detail is the new heavy-duty Campbell 406 Wet Abrasive Cutamatic.

Circle No. 301 on Reader Service Card.

AN EFFICIENT CONTAINER for storing and transporting liquid oxygen, nitrogen and argon is featured in a catalog sheet from Ronan & Kunzl, Inc. Complete information is given on the company's Series 1000 Cryotainer which will hold 115,000 scf of oxygen gas as a self-contained unit or as a truck mounted unit.

Circle No. 302 on Reader Service Card.

A FUNCTIONAL LINE of automatic welding head manipulators is described and illustrated in a 4-page brochure from Lewis Welding & Engineering Corp. Form 7703-LWE gives specifications and information on five different series of automatic welding head manipulators.

Circle No. 56 on Reader Service Card.

CARBON DIOXIDE WELDING is described and illustrated in a new 24-page booklet available from Air Reduction Sales Company. It covers Aircomatic welding of mild steel and low alloy steels with carbon dioxide (CO_2) shielding gas. The manual provides illustrated description of both the conventional CO_2 and the recently announced Dip Transfer CO_2 processes.

Circle No. 303 on Reader Service Card.

catalogs, handbooks, manuals

MORE THAN 70 DIFFERENT vises, adjustable angle plates, milling and indexing tables are featured in pocket-size Catalog P100 issued by Chicago Tool & Engrg. Co. The complete line of Palmgren products is illustrated in this 18-page publication which contains specifications and prices. **For More Information Circle No. 304 on Reader Service Card.**

RESISTANCE WELDED FASTENERS and parts are the subject of a 50-page catalog issued by Ohio Nut and Bolt Co. Designed as a combination catalog and welding manual, the catalog also contains an engineering section that tells how to get best welds under various conditions. **For More Information Circle No. 305 on Reader Service Card.**

MULTI-ARC WELDING technology and economics are reviewed in an illustrated bulletin from J. B. Nottingham & Co., Inc. The publication explains how the multi-arc principle reduces equipment requirements and simplifies installation and maintenance. **For More Information Circle No. 306 on Reader Service Card.**

FOUR MODELS of "Sureweld" gasoline engine-powered welding units, which provide DC or AC/DC welding current, are described in Brochure NH-179 from National Cylinder Gas Division of Chemetron Corp. Dimensions and specifications are given for each of the welders. **For More Information Circle No. 307 on Reader Service Card.**

COMPLETE TECHNICAL information on its recently introduced Baltograph 300 portable X-ray unit is available from Balteau Electric Corp. A data sheet lists specifications and gives information on operating performance, recommended uses and applications. **For More Information Circle No. 308 on Reader Service Card.**

"HOW TO RANITE TRACTOR RAILS" is a new four-page data sheet from Rankin Mfg. Company. It gives step-by-step procedures, with diagrams, for proper methods of rebuilding tractor rails. Data Sheet #102 tells what to do—and what not to do, also. **For More Information Circle No. 309 on Reader Service Card.**

AN APPLICATION MANUAL for industrial use of rubberized abrasives has been published by Cratex Mfg. Co., Inc. The manual includes case histories and a copy of the latest Cratex catalog. **For More Information Circle No. 310 on Reader Service Card.**

OPERATING DATA for the "Dual Shield" carbon dioxide welding process is contained in a new brochure from National Cylinder Gas Division of Chemetron Corp. Brochure NH-636 gives data for automatic welding mild steel. Data for mild steel spot welding is also included. **For More Information Circle No. 311 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

KNOWING
what you will need
IS HIS BUSINESS

Your LINDE Distributor is an independent local businessman who concentrates on knowing what you are going to want and on having it ready for you. He's a welding specialist, too, with wide practical experience and intimate knowledge of local industry. Knowing is part of his job. Maintaining adequate stocks for immediate delivery is another.

So your LINDE Distributor carries a complete line of welding and cutting equipment, industrial gases, welding rods, and supplies. He handles high-quality products of proved efficiency and recommends processes and methods best suited to your needs. His resources, plus the benefits of LINDE's 50-odd years as a leader in welding and cutting, are as near to you as your telephone.

Talk to your LINDE distributor today. Get to know him better. If you can't find his name in your telephone directory, write to: Dept. 311, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

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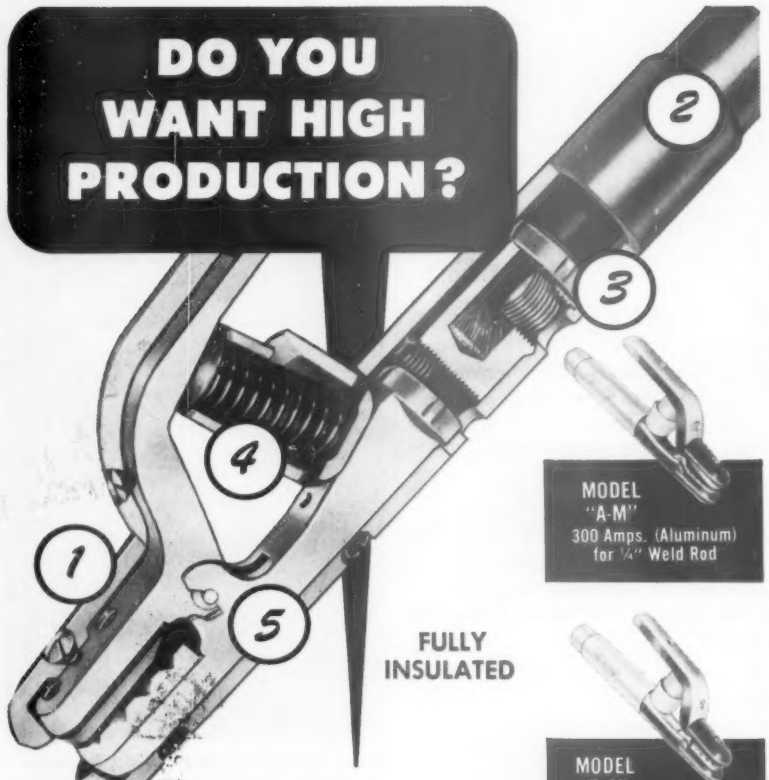
DO YOU WANT HIGH PRODUCTION?

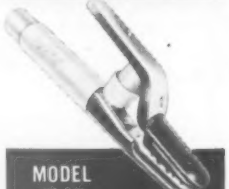


FULLY INSULATED

MODEL "A-M"
300 Amps. (Aluminum)
for ¼" Weld Rod

MODEL "C-S"
250 Amps. (Copper Alloy)
for 7/32" Weld Rod

MODEL "C-M"
300 Amps. (Copper Alloy)
for ¼" Weld Rod



MODEL "C-L"
500 Amps. (Copper Alloy)
for ⅜" Weld Rod

SuperGrip™ PRODUCES
more work, safer, easier!

SuperGrip Electrode Holders are designed to make easy all operations in welding...from attaching Holder to cable on through to depositing weld metal in any welding position!

YOU GET MORE out of *Super-Grip* for these reasons:

1 RUGGED, LONG WEARING interchangeable jaw insulators are easily replaced *QUICKLY*. Jaw pads of the aluminum Model "A-M" are easily replaced.

2 EXCLUSIVE NECKED-DOWN HANDLE cuts "cable fatigue" and "down time" by reducing cable play at handle end and close to cable connection...prevents fraying and fatigue of wire strands... makes *SuperGrip* firmer, handier working tool.

3 BALL POINT SET SCREW of "man-size" diameter really *grips* cable tightly...can be tightened without removing handle...provides maximum current-conducting cross section...minimizes re-connections to save time.

4 POWERFUL COMPRESSION of enclosed spring puts extra "bite" in *SuperGrip* jaws...minimizes electrode waste or loss.

5 PERMANENT PIVOT BUSHING in tongue of trigger assures alignment, minimizes wear and increases service life of the Model "A-M" Aluminum Holder. Positive grip helps produce more... better work.

Get our Bulletin No. 65 or...
Ask your Welding Distributor!

The FIBRE-METAL Products Company | CHESTER PENNA.

In CANADA: Fibre-Metal (Canada) Limited, Toronto

See us at the WELDING SHOW—Booth 702—Los Angeles
For More Information Circle No. 34 on Reader Service Card.

BASIC ENGINEERING DATA on wire and powder sprayed coatings of metals and ceramics are the subject of Bulletin 136A issued by Metallizing Engineering Co., Inc. Described and illustrated are equipment and supplies. Characteristics of sprayed metal coatings are given along with application information.

Circle No. 312 on Reader Service Card.

CUSTOM ENGINEERED TOOLING for precision automatic welding of air weapon structures is the subject of Bulletin MT-200 from Lewis Welding & Engineering Corp. Described and illustrated are custom engineered tooling packages that adapt advanced automatic welding techniques to missile manufacturing.

Circle No. 102 on Reader Service Card.

A NEW ACETYLENE GENERATOR devloped to accommodate 2" x 0" (run-of-crusher) carbide for acetylene generation is featured is a 4-page brochure from Sight Feed Generator Co. Complete data and specifications are given for the company's new Model ATX generator.

Circle No. 313 on Reader Service Card.

A SPOT WELDING GUN made by ARO Spot Welders Division of Guthery Machine Tool Corp. is featured in a 4-page brochure. Complete details, including information on built-in transformers, gyroscopic suspension and water cooling, are given on the company's No. 510 unit.

Circle No. 314 on Reader Service Card.

A HARD SURFACING fact file is offered by Metal & Thermit Corp. An individual card for each type of open arc and submerged arc hard surfacing electrode and wire provides full technical information. Also included are two selection charts, a reference application chart and a mechanical property chart.

Circle No. 315 on Reader Service Card.

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMPS

BECAUSE . . . whatever the size or shape of the workpiece you wish to hold—wherever you have to push, pull or lock with forces from 50 to 10,000 pounds—it's a hundred-to-one there's a DE-STA-CO Toggle Clamp to fit the job! And if not, our engineering staff will show you how easily one may be adapted! . . . 13 basic styles and over 140 models! Photo shows typical size range. . . . Complete template sets available.

FOR MORE FACTS
CHECK BOOTH 1054
DETROIT TOOL SHOW

YOU CAN
DEPEND ON DE-STA-CO

DETROIT STAMPING COMPANY
350 MIDLAND AVENUE
DETROIT 3, MICHIGAN

Circle No. 24 on Reader Service Card.

A STUD WELDING SYSTEM developed by the Fastening Division, OMARK Industries, Inc., is featured in Form No. G9-4. Technical data and information is given on test strengths of studs and their application.

Circle No. 316 on Reader Service Card.

WELDING FITTINGS and flanges in 36-inch nominal pipe sizes are the subject of Technical Bulletin FDC-275 issued by Babcock & Wilcox Co., Size, dimensional and physical data is included.

Circle No. 317 on Reader Service Card.

MEASURING SURFACE RESISTANCE of sheet metal prior to resistance welding is explained in Bulletin 3052 from J. E. Dice Co. Featured is company's Model 151-S Microhm Meter.

Circle No. 318 on Reader Service Card.

SPOT WELDING MACHINES made by the Atomic Spot Welding Co. are the subject of available literature. Complete information is given on design details and operating characteristics of a complete line of spot welders.

Circle No. 319 on Reader Service Card.

AN INSTRUCTIVE 4-page brochure issued by American Emery Wheel Works describes in detail the company's new Duraflex dished-depressed center grinding wheel. Design characteristics and safety features are explained.

Circle No. 320 on Reader Service Card.

ARC WELDING ACCESSORIES and supplies for every use are featured in a new 16-page arc welding supply catalog issued by Hobart Brothers Co. Ask for Catalog EW-211.

Circle No. 321 on Reader Service Card.

NEW STAINLESS COMPARISON CHART just completed by Peter A. Frasse & Co., Inc. (Sec. A, No. 4) provides a comparison of properties for 18 different grades of stainless steel.

Circle No. 322 on Reader Service Card.

IT'S A FACT

YOU CAN DO BETTER WITH

DE-STA-CO

TOGGLE CLAMP DELIVERY

BECAUSE, with stocking Distributors from coast-to-coast, you can always get quick delivery of the right clamps for the work at hand . . . WHEN YOU NEED THEM!

Whatever the size or shape of the piece to be held—wherever you have to push, pull or lock with forces from 50 to 10,000 pounds—it's a hundred-to-one there's a DE-STA-CO Toggle Clamp in stock to fit the job exactly.

FOR YOUR NEARBY DISTRIBUTOR CONSULT YOUR YELLOW PAGES!

FOR MORE FACTS
CHECK BOOTH 1054
DETROIT TOOL SHOW

YOU CAN
DEPEND ON DE-STA-CO

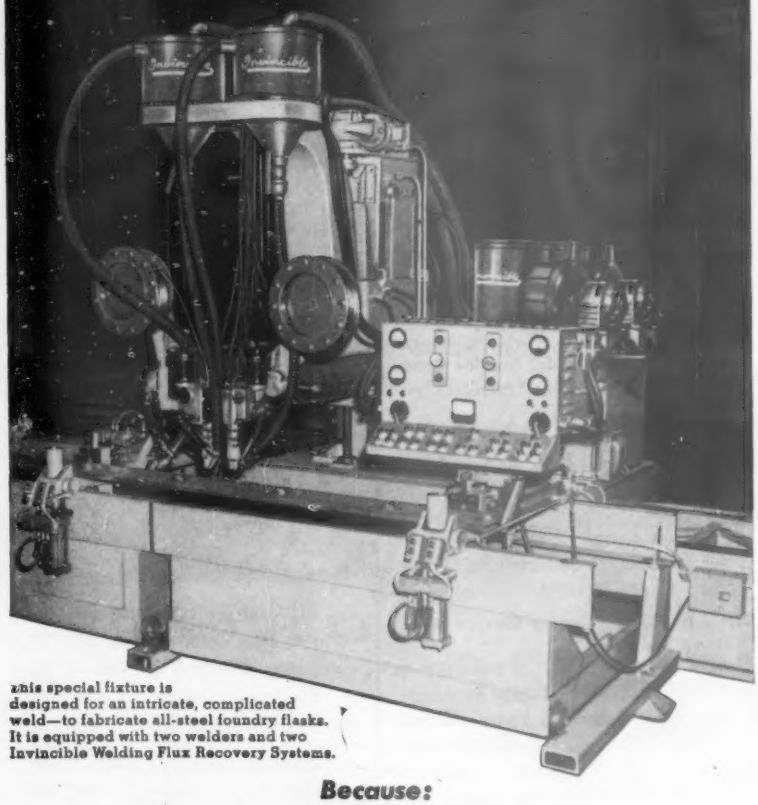
DETROIT STAMPING COMPANY
350 MIDLAND AVENUE
DETROIT 3, MICHIGAN

Circle No. 25 on Reader Service Card.

Welding Fixture and Positioner Manufacturers Specify . . .

INVINCIBLE

WELDING FLUX RECOVERY SYSTEMS



This special fixture is designed for an intricate, complicated weld—to fabricate all-steel foundry flasks. It is equipped with two welders and two Invincible Welding Flux Recovery Systems.

Because:

- INVINCIBLES recover *all* unfused flux on submerged arc welding jobs, remove powder and return slag-free, dust-free flux to the welder in a *continuous* flow. Savings in reclaimed flux *alone* repay their cost in a few months, or even weeks. And they save costly man-hours over manual methods, speed production, minimize costly rejects by eliminating flux flour.
- INVINCIBLES are available in 14 standard automatic and manual models from 1½ to 7½ horsepower *plus* special machines and combinations. All feature compactness, flexibility and rugged construction.
- INVINCIBLE's resident engineers in all principal cities will assist you in achieving maximum savings from submerged arc welding operations.

***SEND FOR FOLDER** on Invincible Flux Recovery Systems*

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

For More Information Circle No. 51 on Reader Service Card.

HIGH STRENGTH STEELS available from Great Lakes Steel Corp. are the subject of a comprehensive brochure. Composition and physical properties are given for N-A-X High-Tensile and N-A-X Finegrain. Welding and fabricating techniques are given along with suggested applications.

Circle No. 323 on Reader Service Card.

PIPE CLAMPS for every welding job are subject of literature from Jewel Mfg. Co. Described and illustrated are pipe, elbow, angle and flange clamps and a pipe marker for marking hole and saddle on any pipe up to 20-inches.

Circle No. 53 on Reader Service Card.

HOW REMANUFACTURED ignitron tubes (fob factory exchange) save almost 50 percent of new tube costs is explained in literature from Industrionics, Inc. A one-year warranty and trial use are described.

Circle No. 49 on Reader Service Card.

PORTABLE SPOT WELDER made by Merit Company is described and illustrated in catalog. Design details and operating specifications are given for water- and air-cooled models.

Circle No. 65 on Reader Service Card.

ACETYLENE CYLINDERS manufactured by Independent Engineering Co., Inc., are the subject of literature offered by the company. Cylinders are described and illustrated in detail; standard and special sizes are listed.

Circle No. 48 on Reader Service Card.

25 DEVICES for safe, efficient materials handling are featured in Catalog C-2 from Merrill Brothers. Among those products featured are lifting clamps and drum lifters.

Circle No. 66 on Reader Service Card.

FLUXES, SOLDERS, SOLDERING SUPPLIES are listed and described in a new catalog C-1 available from Johnson Mfg. Co., Inc. Products shown include general purpose, stainless steel, aluminum, rosin and non-corrosive fluxes, paste solders, tinning compounds; silver brazing fluxes; aluminum and stainless steel solders, and soldering accessories.

Circle No. 324 on Reader Service Card.

BANTAM STUD WELDER introduced by KSM Products, Inc., is the subject of available literature. Described in detail is gun that weighs 33 ounces, is 5½-inch long and welds diameters from 12 gage through ⅜-16″.

Circle No. 116 on Reader Service Card.

FIRST FULLY AUTOMATIC shape cutting machine with unlimited capacity is the way Linde Company describes its Oxweld CM-60 unit. Complete finger-tip control and other construction features are described in a free brochure.

Circle No. 59 on Reader Service Card.

A COMPLETELY DIFFERENT kind of general purpose welding electrode has just been introduced by A. O. Smith Corp. Literature describes the electrode SW-612 as a mild steel rod that handles like an E-6013 and has the characteristics of an E-6012.

Circle No. 86 on Reader Service Card.

A BAR AND ANGLE SHEAR is described and illustrated in literature from Shearease Company. A drawing illustrates the progressive shearing action of the blade when shearing bar stock and angle iron.

Circle No. 328 on Reader Service Card.

OXYGEN CUTTING MACHINES and their advantages are described in a brochure from Messer Cutting Machines, Inc. Featured is what the company calls the largest range of standard oxygen cutting machines available from one source.

Circle No. 70 on Reader Service Card.

...Low Glare & Low Fuming Characteristics Assure Operator Comfort & Quality Results

GB 88 Flux is recommended for silver brazing steel, brass, copper, stainless steel, monel, inconel, chrome alloys, silver and gold. It is known throughout the industry as the "Production" flux . . . proved and dependable. Because operators recognize an improvement in the quality of their silver brazing jobs when they use GB 88. And they like its glare and low fuming characteristics.

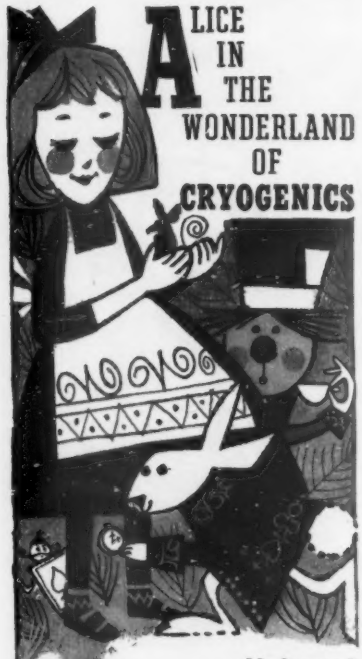
GB 88 Flux is stable in use as well as in storage. It is fully active to 1650°F. Order GB 88 Flux in the size container that suits your needs.

For best results team up GB 88 Flux with GB Silver Brazing Alloys in the shape and size your jobs call for: random coils in all diameters, strips, straight lengths, pre-formed rings and special shapes.

Write for details. A FREE working sample of GB 88 Flux will be supplied promptly on request.

Goldsmith Bros.
DIVISION OF NATIONAL LEAD CO.
900 WEST 18th STREET • CHICAGO 8, ILLINOIS

For More Information Circle No. 39 on Reader Service Card.



ALICE IN THE WONDERLAND OF CRYOGENICS

No longer is CRYOGENICS a fantasy . . . nor do you need a rabbit's hole to reach a world of wonderment. ♠ RYAN's pre-eminence in the Field of CRYOGENIC EQUIPMENT assures your greater existence in a realistic world. ♦ Technical research and development of your equipment requirements by RYAN is the fulfillment of your greatest expectations. ♥ The 3000 SCF Portable Liquid Oxygen Unit complete with automatic pressure building regulator and economizer which delivers in excess of 325 SCFH continuously would be the center of attention at any Tea Party. ♠

Rely on Ryan

RYAN

Industries, Inc.

CRYOGENIC DIVISION

DEPARTMENT B

888 East 70th Street • Cleveland 3, Ohio

Write Today for Technical Literature

Circle No. 81 on Reader Service Card.

NEW PRODUCTS

Plug-In Unit Produces Oxygen

Latest evidence of a trend toward production of commercial hardware by airplane and missile makers appears in the accompanying photo. The box-like cabinet in the background is a bid by Aerojet-General Corp., giant West Coast missiles firm, for welding industry dollars.

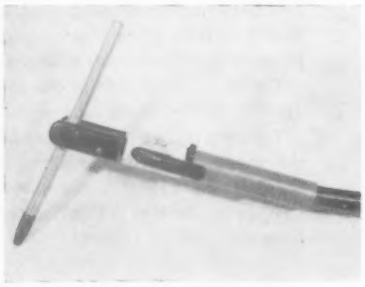
Plug it into a 110-volt electric outlet and it produces 95% pure welding oxygen at a flow rate of 10 liters per minute with 5 lbs. pressure.

The unit extracts oxygen from air, weighs 150 lbs., occupies four square feet of floor area and is insensitive to vibration or position. Oxygen begins flowing one minute after plug-in.

Aerojet plans to power companion units by gas engines or batteries for field operation.

Sales are expected to extend beyond welding into medical applications, for hospital oxygen therapy and use in ambulances.

Circle No. 200 on Reader Service Card.



Metal-Removal Torch

A heavy duty manual metal-removal torch, the H-6, has been announced by the Arcair Co. for fast removal of large areas of metal with 5/8" and 3/4" electrodes. The torch uses an arc to melt metal, and a stream of compressed air to blow it away.

For long life, the H-6 is protected with silicone glass laminate insulation on the moveable head and the torch handle front.

Circle No. 201 on Reader Service Card.

Flame Cutting Table

The Cleveland Crane & Engineering Co. has introduced a flame-cutting table designed to keep repair and replacement costs down. It is made of heat-resistant cast iron, machined to take cones of the same material. Cones are cheap . . . can be replaced without tools. Plates rest on the cones while being cut—with plenty of air space around them to keep cutting heat from reaching the table.

Standard table sizes are 80 x 87 inches and 81 x 63 inches. Material thickness range—1/2 to 12 inches.

Circle No. 202 on Reader Service Card.

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

AC Welders Have Lateral Coil Movement

AC welders in A. O. Smith Corporation's new Premier Line have the same moving coil advantages in welding characteristics and air gap protection as the Challenger models they replace. But, because coil movement in the new design is lateral rather than vertical as much as a foot has been shaved off cabinet height—with no increase in floor space.

An exclusive stacking feature, easier and faster handwheel operation, custom-assembled accessories and competitive prices are other advantages cited.

The line's 300-, 400- and 500-amp welders have a 24-inch width, a 30-inch depth, and a 28-inch height, are as much as a foot lower than conventional machines and can be stacked three-units high.

Circle No. 203 on Reader Service Card.

Silicon Rectifier

A new, small silicon power rectifier is now available from Syntron Company.

The Style 33 silicon power rectifier is rated at 37.5 amperes average at 25°C. ambient on a 5″x5″x1/16″ copper heat sink. Peak inverse voltages range from 50 to 400 volts, in 50 volt steps. Temperature range is from minus 75 to plus 175 degrees centigrade. The unit is mounted on a 11/16″ hexagon stud base. Maximum height is 1-5/16 inches.

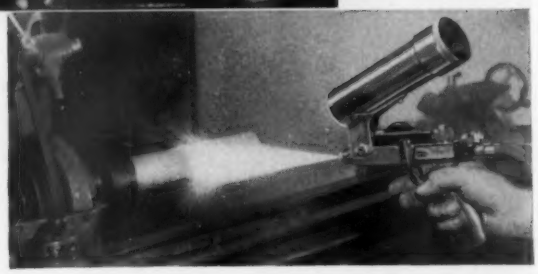
A typical forward dynamic resistance of .0035 ohms is achieved by diffused junction techniques.

Circle No. 204 on Reader Service Card.

Complete your shop with this modern metallizing installation

WIRE GUN
Sprays any metal that can be drawn into wire form.

POWDER GUN
Sprays hard-facing alloys and ceramics in powder form.



Without metallizing no maintenance or "job" shop can offer the same complete service as the shop that uses industry's low-cost "putting-on" tool.

With modern, low-cost metallizing equipment you can spray carbon steels, stainless, babbitts, brass, bronze, nickel, aluminum, tin, zinc, special hard facing alloys including tungsten carbide.

- **Save up to 90% of replacement costs on machine repair jobs**
- **Do your own hard-facing at high speed, low cost**
- **Apply long-wearing, corrosion-resistant coatings**

A real opportunity for the smaller shop

Thousands of large, well-known companies and shops have been metallizing users for many years, not only in maintenance work but in production applications on original equipment. Now, with modern low-cost metallizing equipment this high-speed "putting-on" tool is within the reach of even the smallest shop.

FREE BULLETIN

Send off the coupon for detailed information — find out how a metallizing installation can pay for itself in a very short time. No obligation, of course.

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York

Please send me free bulletin on metallizing.

Name _____

Title _____

Company _____

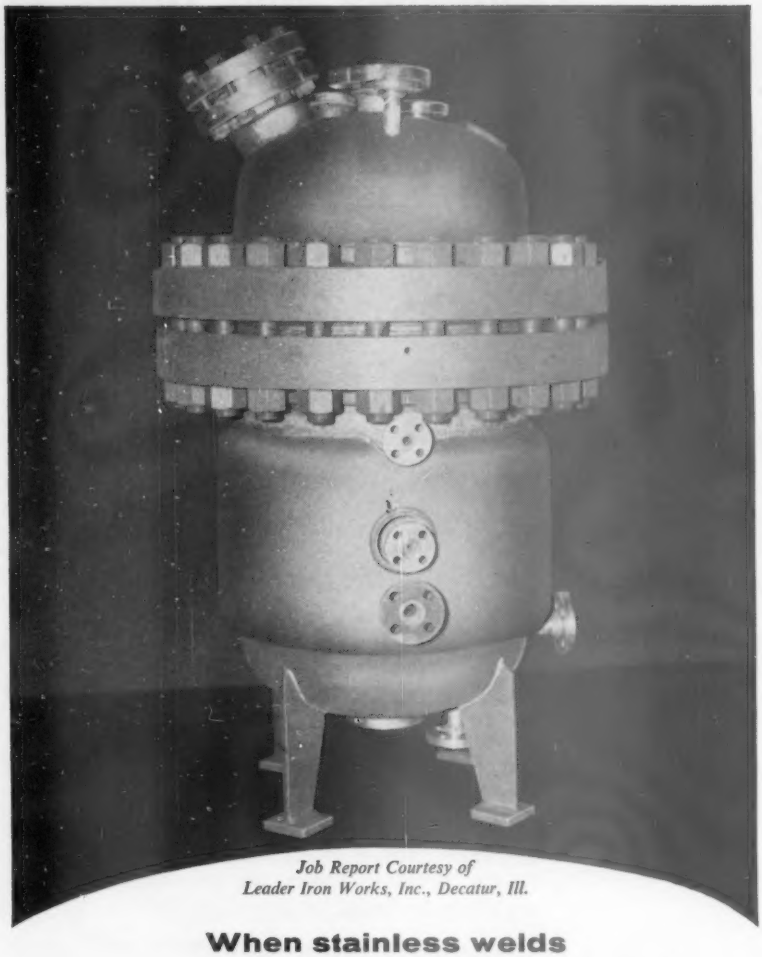
Address _____

City _____ Zone _____ State _____

METCO®

Metallizing Engineering Co., Inc.
Flame Spray Equipment and Supplies
1179 Prospect Ave., Westbury, L. I., New York • cable: METCO
Telephone: EDGEWOOD 4-1300
In Great Britain: METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

For More Information Circle No. 69 on Reader Service Card.



Job Report Courtesy of
Leader Iron Works, Inc., Decatur, Ill.

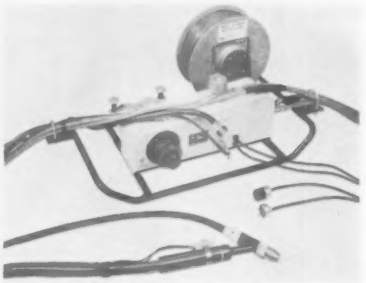
When stainless welds must also resist heat and pressure

This sturdy autoclave made of Type 316 stainless steel must operate under pressures up to 1000 psi at 600°F. Code specifications called for X-ray quality weld. To meet all these conditions for successful and long performance Arcos Chromend KMo (Type 316) electrodes were used for joint fabrication. When you use Arcos Stainless Electrodes you can always count on their providing multiple benefits.

WELD WITH ARCOS

STAINLESS ELECTRODES
for quality weld metal

ARCOS CORPORATION • 1500 South 50th St., Philadelphia 43, Pa.
For More Information Circle No. 11 on Reader Service Card.



Dual Shield Welding

A new Dual Shield arc welding control with wire drive, and a new Dual Shield arc welding torch have been introduced by National Cylinder Gas Division of Chemetron Corporation.

The WC-1 welding control and the AM-1 torch can be used with D-C welding current and may be used in Dual Shield or in other semi-automatic welding processes.

The skid-mounted control has a control motor with a governor that replaces electronic components for the wire drive. The control has a wire feed rate of from 55 to 500 inches a minute for 3/64 to 3/32 inch wire.

The double gate wire drive unit provides positive drive, and tends to straighten wire as it passes through.

The AM-1 torch has a water cooled cup; all cables and hose, aside from the electrode conduit, enter at one point in the handle. The torch is hand-balanced, and has a start-stop switch on the handle.

Circle No. 205 on Reader Service Card.

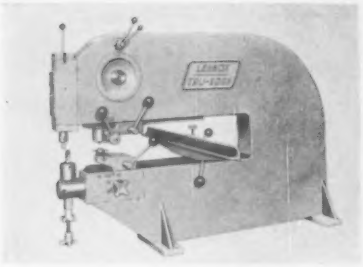
Welder/Power Plant

Miller Electric Mfg. Co., Inc., has announced that a Hercules 38 h.p. 3-cylinder direct injection diesel drives their new DD-250-L d-c welder/a-c power plant, which is claimed to deliver:

Two d-c welding ranges: 50-200 amperes, 150-350 amperes; 100% duty cycle; rated output: 250 amperes d-c at 40v, 100% duty cycle; maximum open circuit voltage: 65; infinite current adjustment steps.

Power is 12 KW, 115-230v single phase, 60 cycle a-c; up to 6.5 KW a-c while welding; 1 KW, 115v auxiliary d-c power while welding.

Circle No. 206 on Reader Service Card.



Shearing And Forming

The TE-100 bench model Metlmastr made by Lennox Tool and Machine Builders is the newest in the Lennox Tru-Edge line of shearing, forming and piercing machines. It has only five moving parts.

The new bench model has an edge-cutting capacity up to 12 gage in mild steel and 16 gage in stainless. It has a ½ hp, 110 volt, single phase motor. It has a variable stroke length that can be adjusted from .022 infinitely through .110 without stopping the motor. The operator just sets the stroke pointer at gage indicated on scale and unit is ready for use.

Strokes per minute, cutting from 1750 up through 3500, are automatically regulated according to material thickness when the operator sets the stroke pointer. It cuts from 8 feet to 15 feet of material per minute.

Circle No. 207 on Reader Service Card.

Flame Cutting Nozzles

A new selection of improved flame cutting nozzles for use with acetylene or fuel gas has been introduced by Linde Co., Division of Union Carbide Corp.

Increased cutting speeds are possible with the new series 1534 and 1535 Oxweld two-piece nozzles designed for use with natural gas.

Metal removing rates in fin-washing operation are said to be doubled with new Oxweld 1523 and 1524 series.

Bendable nozzles (1540 Series) for riser removal and cutting in hard-to-get-at spots are included in the new selection.

The new 1539 Series nozzles are used to "wash" off rivet heads and pierce rivet holes without danger to steel plate.

Circle No. 208 on Reader Service Card.

What's different about Arcosarc Wire Drive welding equipment...
RUGGED CONSTRUCTION
portable—compact
LOW MAINTENANCE
simple electrical and mechanical design
FULL OPERATOR CONTROL
pistol grip hand gun with both gas flow and wire advance control
USES EXISTING POWER SOURCES
no extra equipment needed
Arcosarc

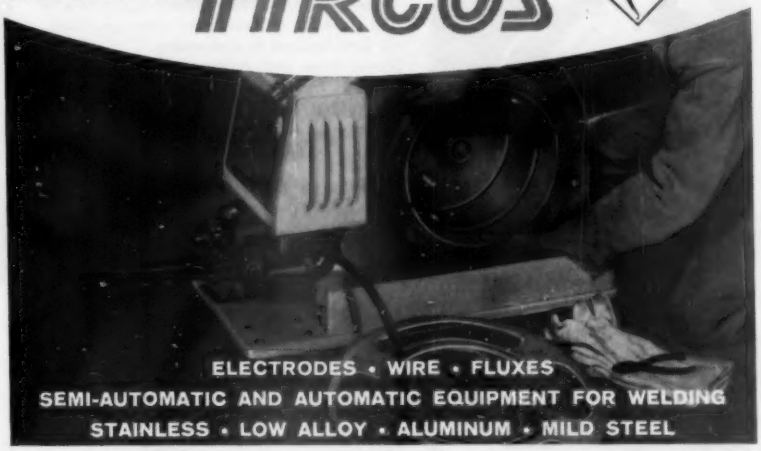
New Arcosarc Equipment

—for CO_2 welding of Mild and Low Alloy Steels

—for inert gas welding of Aluminum and Stainless

Here is a "bonus producing" wire feed unit for a variety of welding jobs in pipe, pressure vessel, structural steel fabricating shops, and foundries. Full instant control in the hand gun of the wire feed and gas flow along with the open arc give the welder the fullest opportunity to produce high quality weld metal consistently. Continuously fed wire eliminates stub losses, and the inconvenience of start and stop procedures. For the welder, ARCOSARC equipment improves manual operation; for the fabricator, it helps to keep costs under control.

WELD WITH ARCOS



ELECTRODES • WIRE • FLUXES
SEMI-AUTOMATIC AND AUTOMATIC EQUIPMENT FOR WELDING
STAINLESS • LOW ALLOY • ALUMINUM • MILD STEEL

ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

For More Information Circle No. 12 on Reader Service Card.

For More Information Circle No. 6 on Reader Service Card.

DOC TUFFY TO THE RESCUE

HMMMMM — SPOT WELDMENTS LIKE PERFORATED PAPER. THAT'S NEW!
BURN-THROUGH! WARPING! ALL KINDS O' TROUBLE, DOC! WHAT'M I GONNA DO?
NOW YOU JUST FOLLOW THOSE TUFFALOY CATALOG SUGGESTIONS, AND YOU'LL SEE A REAL IMPROVEMENT!

TUFFALOY COLD FORMED TIPS do a better job than forged or cast tips. But you weld better with *any* electrode when you follow the suggestions in the Tuffaloy catalog. It has information on tips, shanks, holders, bar stock, accessories and prices. Call your Airco or Tuffaloy office.

TUFFALOY

AIRCO

AIR REDUCTION SALES COMPANY
A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.
Air Reduction Pacific Company; Air Reduction Canada Limited

100%

...100% of their cost in less than a year earned by WELD-REEL and REEL-KING Hose and Cable Reels in TIME-SAVING alone!

Savings in wear and damage under average shop conditions will raise the figure to 200%.
These automatic reels enable operators to coil up hose or cable—no slow uncoiling, no time wasted in unsnarling.
Stores hose and cable when not in use—protects from wear and from damage due to falling objects, kicks, sparks, cuts, trucks, etc. Service life has been increased as much as five times.

UNITED SPECIALTIES, INC.
BOX 698 - EL DORADO, ARKANSAS
Distributed in Canada by
CANADIAN LIQUID AIR CO., LTD., Montreal

WELD-REEL
REEL-KING
Write for brochure

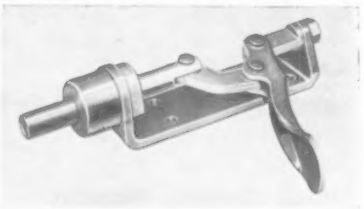
UNITED SPECIALTIES, INC.
Please send catalog application brochure
NAME_____
COMPANY_____
STREET_____
CITY_____STATE_____

For More Information Circle No. 95 on Reader Service Card.

Plastic Welding Filter

Plastic-Weld filters developed by Chicago Eye Shield Co. remove the harmful ultra-violet and infra-red rays of arc welding and filter them to the same degree as the standards set for glass in Federal specifications. Available in the standard 2″ x 4½″ size and a 7″ x 11″ panoramic window version, these filters will outlast glass by as much as 6 to 1. The 2″ x 4½″ filter encased in a rubber gasket weighs less than one ounce as compared to two and a half ounces for a glass filter of equal size. The 7″ x 11″ filter weighs four and a half ounces.

Circle No. 209 on Reader Service Card.



Plunger-Type Clamp

A new plunger-type toggle clamp with a swivelling handle for use where clearance requirements do not permit using conventionally designed clamps has been added to the standard line of De-Sta-Co clamps. Designed for medium-duty holding applications, the new clamp, designated Model 606, was developed by Detroit Stamping Company. The handle swivels in a 220-degree arc and can be fixed in any position within this arc by a lock-nut located on the axis of rotation.

Rated holding pressure of the new clamp is 450-lbs. Overall clamp length with the plunger in an extended position is 6½-inches. Plunger travel on a complete stroke is 1⅜-inch. Height from the base to

get Surface Hardness where it COUNTS!

Whether your problem is a load bearing surface, a wearing surface, a cutting edge or an impact edge—it's the **surface hardness** that counts.

Now, using HARD-N-TUFF right in your own shop with no special tools, you can harden your own tools and parts. HARD-N-TUFF is the only steel hardening compound that carburizes, nitrides and chromizes in one, simple operation. You automatically multiply the **useful life** of your tools and parts when you treat them with "factory proven" HARD-N-TUFF.

Harden the **entire part**—or **only** the **critical area.** Simply heat, apply compound, reheat and quench . . . and you have the hard surface you need . . . backed up by a tough, non-brittle core.

Send for complete fact sheets or order your trial supply now!

Generous trial supply $2.00
1 lb. can $8.95

HARD-N-TUFF®

HARD-N-TUFF CORPORATION
BOX 275, HUNTINGTON, N. Y.

Circle No. 104 on Reader Service Card.

the centerline of the plunger is 7/8-inch.

Circle No. 210 on Reader Service Card.

CO_2 Welding Gun

A new manual Aircomatic (Air Reduction's gas-shielded metal-arc process) welding gun for use on mild steel using carbon dioxide (CO_2) as a shielding gas has just been placed on the market by Air Reduction Sales Company.

The air-cooled gun, designated Model AH60-B, has a continuous duty rating of 600 amperes DC when using "buried arc" CO_2 techniques. It can accommodate hard welding wires ranging from .035" through 3/32" fed from conventional Airco wire feeders..

Circle No. 211 on Reader Service Card.

Spot-Projection Welder

The new combination spot and projection welder, Model ARKN, developed by Alphil Spot Welder Mfg. Corp. features combination large platen and standard arm arrangement, flexibility for die mounting, precision roller-bearing ram, high speed, and extreme ruggedness.

Alphil's ARKN is available in current capacities from 50 to 200 KVA for welding 16-gage commercial aluminum and 7-gage cold rolled steel.

Circle No. 212 on Reader Service Card.

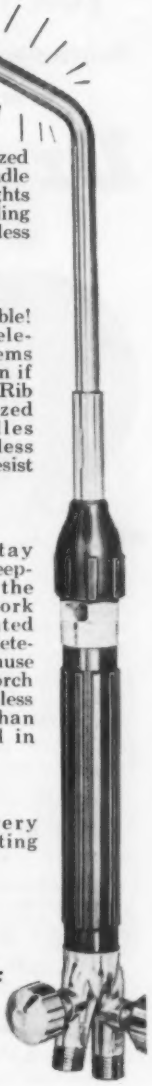
Aluminum Fittings

Addition of aluminum and other alloys to its versatile, low-cost line of light wall "Pipe-Mate" fittings and flanges has been announced by Tube Turns Division of Chemetron Corporation, Louisville, Ky.

Pipe-Mate fittings of Type 6063T6 high strength aluminum alloy will be available in 1/2" to 4" pipe sizes, Schedule 10S. Other aluminum alloys are also available. Tube Turns said, as are nickel, Monel, copper-nickel, and most other weldable alloys.

Circle No. 213 on Reader Service Card.

WHY
THIS TORCH SPEEDS WELDING
3 ways!



1 LIGHTER . . . high strength anodized aluminum alloy handle reduces torch weights by one-third. Welding is done faster, with less operator fatigue.

2 STRONGER . . . and more dependable! Spring loaded, telescoping valve stems are protected even if torch is dropped. Rib reinforced, anodized aluminum handles with tough stainless steel torch heads resist wear-damage.

3 COOLER . . . torch handles stay comfortably cool, keeping operators on the job with fewer work breaks. Over-heated handles are completely eliminated because the stainless steel torch head is seven times less heat conductive than brass heads used in other torches.

4 MODELS

A model for every welding and cutting need.

- *Super-Jet*
- *Aero-Jet*
- *Star-Jet*
- *Jet-O-Matic*

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MANUFACTURING COMPANY, INC.
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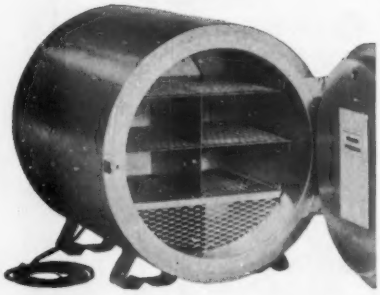
YOU CAN KEEP 'EM DRY

FOR 14c A DAY

Moisture-proof your electrodes at low cost with

DryRod® OVEN



Fourteen cents worth of electricity per day — that's about all it takes to operate the popular, Type 300 DryRod electrode oven. At that rate, and its low purchase price, you can't afford to be without DryRod protection against moist mineral coated rods. Insure your electrode investment against:

- POROSITY • UNDER-BEAD CRACKING
- ROUGH WELDS • ROD SCRAP LOSS
- REJECTS • REWORKS
- PRODUCTION SLOWDOWN

NEW! 800° or 1000° HIGH TEMPERATURE Re-baking Oven now available

The DryRod line of ovens now includes four basic models to meet every welding requirement.

Write for new folder "DryRod as Standard Welding Equipment".

PHOENIX PRODUCTS COMPANY
4731 N. 27th St. • Milwaukee 9, Wis.

Circle No. 75 on Reader Service Card.

Welding Heat Control

Sciaky Bros. has announced a new optional form of heat control:—the Automatic Voltage Compensator (AVC) for Sciaky resistance welding machines of the Dekatron type. The unit reduces and even eliminates excessive voltage fluctuations weld inconsistencies.

Electronic circuitry of the AVC automatically shifts phase of firing pulses which control the heat regulating function of thyratrons within the power rectifier cabinet. By advancing the phase of these pulses when line voltages surge or drop within plus or minus 10%, weld current can be held to within plus or minus 2% or less at any given setting on the heat control dial. Full correction is made within one-third of the cycle.

Circle No. 231 on Reader Service Card.

Metal Fabricator

Wales-Strippit, Inc., a unit of Houdaille Industries, Inc., has introduced a new model of their Strippit Fabricator. This machine is designed for punching, notching and nibbling, particularly for prototype work, short or medium production runs.

Designated Model 15A, this latest version features a new Electro-Hydramatic head which is the part of the machine controlling the power stroke of the ram. This new feature of the Fabricator eliminates the need for pressurized air required on earlier models.

The Model 15A Strippit Fabricator punches round or shaped holes up to 3½" in diameter in any sheet material (including printed circuit boards) up to ¼" mild steel. Its maximum notching capacity is 5" x 5" in ⅛" mild steel and it will do straight line or shearing at 165 strokes per minute in ⅛" mild steel.

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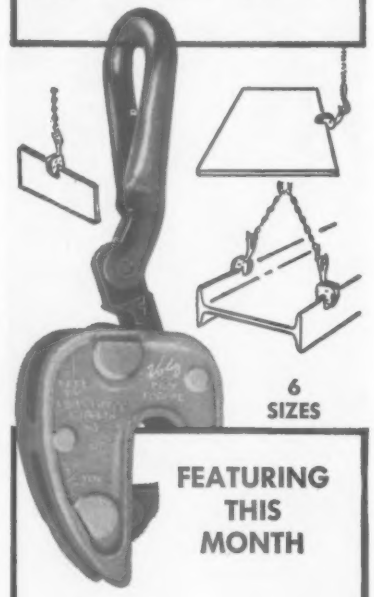
Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



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Rated capacity — 3 ton (6 tons per pair). Completely drop forged . . . Heat treated.

Over 25 Material Handling Devices described in our catalog C-2.

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1-60

Circle No. 66 on Reader Service Card.

For More Information Circle No. 47 on Reader Service Card.

Micro-Wire Welding

Micro-wire welding is a new automatic welding process developed by Hobart Bros. Co., Troy, Ohio, for carbon dioxide shielded arc welding of mild steel from 24 gauge to ¼ inch thickness.

The process was named for the small .020 to .045 diameter welding wire that is fed continuously from a spool into the weld zone. Equipment for the process includes a lightweight gun-cable assembly, a wire feed unit, gas supply and regulation apparatus, and a power source of the constant voltage or variable slope type.

The process was developed for high speed welding of sheet metal in lighter gauges not considered readily welded by any other process. Another application is poor fit-up work such as the bridging of ¼ inch gaps on 14 gauge mild steel.

Advantages of the process are high welding speeds in all positions with a minimum of distortion and little or no post-weld cleaning.

Circle No. 46 on Reader Service Card.

Safe Portable Nibbler

Model AN air-powered Fenway Nibbler is a 12 lb. tool made by Fenway Machine Company, Inc. It is designed to provide maximum protection to the operator.

Operating on a punch and die action, sheared pieces of metal drop down and are not hurled upwards. This eliminates the possibility of injury to the eyes. In addition, it is specially constructed to make it impossible for the operator's fingers to come in contact with the punch.

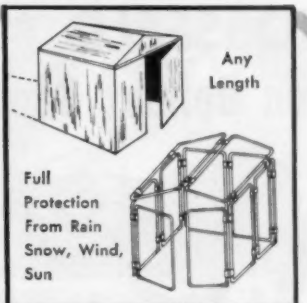
The Fenway Nibbler can cut 3/16" copper, brass, aluminum 10 gauge stainless steel and 8 gauge mild steel at a minimum radius of 6".

Circle No. 216 on Reader Service Card.

For More Information Circle No. 37 on Reader Service Card.

NEW HANDI-HUT FROM STANDARD SERIES "60" PORTO SCREEN PANELS

FOR WELDING IN THE FIELD



Low-cost protection in minutes for production or maintenance welding. Porto-Screen panels make a complete Handi-Hut . . . or, you can use individual panels in many combinations for hundreds of everyday applications. Entire assembly folds compactly for storage or transporting, assembles without tools, is lightweight and durable.
In standard sizes 6′ x 6′ x 7′ high and 12′ x 6′ x 7′ high. Choice of fabrics.

Write for illustrated literature, prices, and name of nearby distributor.

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HANDI-HUT SECTIONS CAN BE USED FOR —

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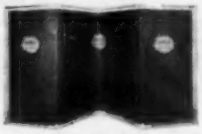
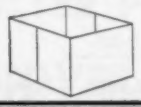


Room Dividers



Wrap-Around Screens

"We, of Coyne Cylinder Company, sincerely hope you will visit booth 505 at the AWS Welding Show in Los Angeles, because nothing else tells our story better than your 'seeing for yourself' the outstanding investment value built into every Coyne Acetylene Cylinder."

"To make your visit with us even more helpful and informative please let us send you our literature in advance of 'show time.' Write or call now!

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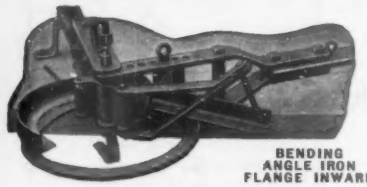
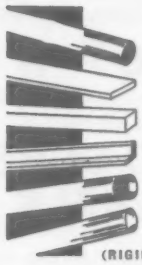
For More Information Circle No. 23 on Reader Service Card.

For More Information Circle No. 47 on Reader Service Card.

HOSSFELD #2 Universal®
Iron Bender Bends



BENDING ANGLE IRON FLANGE INWARD



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- Versatile, 147 different dies are available.
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- Invaluable, optional hydraulic equipment makes the job easier.
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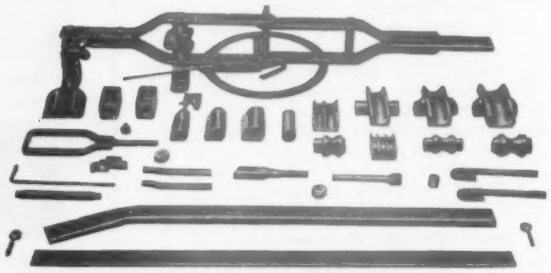

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Acetylene Cylinders

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For More Information Circle No. 48 on Reader Service Card.

Safety Hats And Caps

Bausch & Lomb announces an expansion of their safety products with the introduction of a complete line of safety hats and caps. The headgear is available in a choice of fibreglass, aluminum and plastic (electrical), covering a full range of standard colors.

An outstanding feature of the hats is a new, contour-fit suspension which has been achieved by a unique design of pliable polyethylene. The hats conform to the head, giving "soft-hat" comfort without top-heavy feeling. Lock straps assure minimum crown clearance of 1¼", which can be increased, if necessary. A numbered snap-in adjustment provides quick, easy fitting to any head size from 6⅝ to 8. Suspension may be left intact for cleaning and sterilization, but can easily be removed for replacement. Plastic-zippered sweat band can be taken out and replaced without affecting suspension.

Circle No. 217 on Reader Service Card.

Heated CO_2 Manifold

This new heated CO_2 Manifold is made by World Electric Co. It connects two CO_2 cylinders for parallel operation and is internally heated. The heat feature prevents regulator freeze-up on CO_2 welding applications.

Designated the WELCO AF-2 Manifold, it comes complete with fittings and gaskets, less regulator and flow meter.

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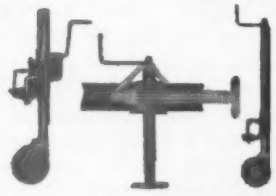
a constant source of business for you . . .

A complete line of - Axle Assemblies, Trailer Undercarriages, Farm & Trailer Jacks, Implement & Trailer Couplers, Spindle End Assemblies

BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



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Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

Contact our engineering department for full details on your particular application — a FREE service to you — write for Catalog 18D.

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HAMMER BLOW TOOL CO.

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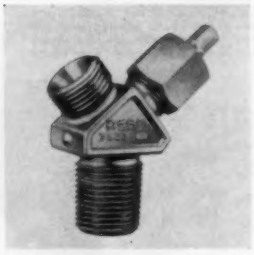
Circle No. 42 on Reader Service Card.

Ultrasonic Inspection

A unitized Reflectoscope that provides maximum flexibility in law detection through low cost interchangeable plug-in units has been developed by Sperry Products, Inc. Called the UM Reflectoscope, the new instrument permits selection of only the necessary components for a testing job and provides a means for adding to instrumentation to meet increasing or changing testing requirements.

This portable Reflectocsope is approximately 7½" high, 20" wide and 20" deep and weighs about 35 pounds. An attached handle lets it be carried like a piece of luggage. The handle can be folded under to tilt the instrument in testing position for easy viewing. The basic instrument contains three major components: (1) the display unit with a 5" cathode ray tube, display controls and instrument power supply; (2) Pulser /Receiver unit and (3) time control unit.

Circle No. 219 on Reader Service Card.



Cylinder Valve

A new valve for cylinders containing no more than 10 cubic feet of acetylene, has been announced by the Bastian-Blessing Co. The valve features a plier-proof case-hardened stem; leak-proof NGT inlet threads; protected fusible plug; and a large wrenching area. Each valve is date stamped to ease record keeping. The RegO model 7321 valve has a forged brass body with 3/8" NGT inlet and CGA 201 outlet connections.

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INSURES GREATER *Safety*

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FILTER PLATES and COVER LENS are *FIRST CHOICE* EVERYWHERE

Thermo Filter Plates guaranteed to have less variation in density. Blue-green tint eliminates fatigue and eye-strain.

Laboratory tests prove Sta-Kleer All-Plastic Cover Lens last longer because they are more heat and scratch resistant.

Triple-Duty Glass Coated Cover Lens outsell all others on the market because they repel molten weld slag. Will not peel or discolor.

THERMACOTE COMPANY
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For More Information Circle No. 79 on Reader Service Card.

Use Oxygen? Nitrogen? Argon?

Have You Considered a LIQUID STORAGE Cryotainer?®

(Low-loss containers for storage and transport in capacities from 5,000 to 250,000 SCF)

Over 2,000

dependable Cryotainers are now in use

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★ EACH ONE FACTORY TESTED
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★ ALL PARTS STOCKED

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Flood FIBER GLASS WELDING HELMETS

For Safety, Comfort and Economy

These seamless fiber glass units (of thermo-setting, polyester resin) are compression-molded and sturdily reinforced to afford maximum protection. All are fitted with the new Fit-Rite, snap on, ratchet type headgear—the most comfortable, durable and easiest-to-maintain you can buy, and not more expensive.

No. 51-8F-2H

NEW DESIGN ADVANTAGES

1. Lighter weight for more comfort.
2. A smoother and stronger shell.
3. Easier cleaning and sterilizing.
4. Non-warping moisture-proof construction.
5. Superior resistance to heat.

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No. 51-2F-2H

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1000-HOUR COVER LENS

Outlasts 125 glass lenses. Reduces eye fatigue. Safer because shatter-proof.

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FLOOD SAFETY PRODUCTS CO.

3037 WEST LAKE STREET, CHICAGO 12, ILLINOIS

For More Information Circle No. 35 on Reader Service Card.

Spike Welder

A new spike welder for blemish-free welding of coated metals and for welding of non-ferrous metals, dissimilar materials and delicate parts has been developed by Weldex Division of The Metal/Craft Company. The machine is said to combine the advantages of normal capacitor discharge spot welding and percussion welding and eliminates or nullifies most of their disadvantages.

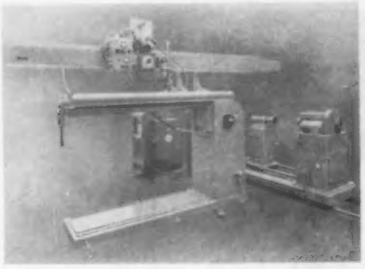
The new welder produces 100,000 plus ampere pulses of approximately one millisecond duration, yet requires no additional service lines. Because the spike welding method generates heavy currents in very short times it offers equivalent welds with a much smaller machine than would be normally used.

Circle No. 221 on Reader Service Card.

Safety Spectacles

Unispec Twins safety spectacles are made to fit every face easily, comfortably. Advanced design incorporates many new features. Two models cover five bridge sizes. Model 7446 fits 18, 20 and 22mm bridge sizes; Model 7448 fits 22, 24 and 26mm bridge sizes. Each model fits a 22mm bridge size. Unispec Twins are manufactured by Glendale Optical Company.

Circle No. 222 on Reader Service Card.



Positioner For Automatic Welder

A new combination longitudinal and circumferential positioner, which uses a single, common TIG welding head station, carriage, track, power supply and control, has been announced by Airline Welding and Engineering. The machine will accurately weld longitudinal parts up to 72″ long and diameters to 52″ at 48 ipm. It will position circular parts from 1″ to 60″ diameter by 74″ long weighing up to 1,000 lb. Stepless rotation speeds are 0.09 and 9.75 rpm.

Circle No. 223 on Reader Service Card.

New Bench Welder

A small, press-type bench welder designed for extra fine and critical welding has been introduced by Universal Electroweld Division of Electric Arc., Inc. The machine is one of the company's new line of single phase resistance welders.

The new bench welder brings a higher capacity and wider work range to the same type of fast, sensitive and automatic operation which had been the special field of the tweezer-type and miniature press welders, according to Otto Kriesel, chief engineer.

Circle No. 224 on Reader Service Card.

Flexible Shaft Grinder

Wyzenbeek & Staff, Inc., announces a new 1 HP WYCO "Handy Grinder", mounted on a four-leg caster base. The entire swivel base and handle are of welded steel construction, light in weight and at the same time, unbreakable. A variety of attachments and accessories are available.

Circle No. 225 on Reader Service Card.

For More Information Circle No. 3 on Reader Service Card.

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FLUX

you name it—ALL-STATE has it

ALL-STATE makes quality fluxes for torch and soldering iron applications on all commercial metals . . . in the form you prefer: liquid, paste, powder, flux cored solders, flux coated rods. Working temperatures range from 300F to 2200F. Designed for maximum wetting action, minimum fuming. For instance:

DUZALL . . . a new liquid flux for all soft solders, all metals (except light metals). DUZALL eliminates pre-cleaning, increases capillary action, leaves minimum deposit. Comes in handy 4 oz. refillable dispenser-type plastic containers, and in larger units.

#11 BRAZALOY® . . . a paste or powder flux for use on 14 ferrous and bronze alloys. Wide temperature range: 1200F to 2200F. Non-corrosive, non-fuming. Also available extruded on Nickel Silver welding rods.

#31 BRAZALOY® . . . a highly active aluminum brazing flux that gives maximum wetting action, excellent capillary flow. Protects surfaces from discoloration, requires less after-cleaning. An outstanding temperature indicator.

S200 SILVER BRAZING FLUX . . . melts at 600F, becomes transparent at 1100F, protects heated base metal to 1800F. Induces excellent capillary action and flow of silver alloys.

Send for free copy of 54-page Instruction Manual and for information on custom coating your welding rods.

All-State's JET FLUX® and JET FLUX DISPENSER® on production line at Griggs Manufacturing Co. Acetylene and Jet Flux mixed and fed automatically from Dispenser.

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Distributor-Stocked, convenient to buy. Economical to use.

ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.

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THE NEWEST PORTABLE SPOT WELDER

Merit Might Midget

Completely new . . . and engineered for today's production demands . . . the Merit Might Midget is the perfect answer to all your welding problems.

- Trouble-free electronic timer and contactor
- Welds up to 3/16" combined thickness
- Uses standard #1 Morse taper tips
- Variable tip pressure—0 to 1000 lbs. in seconds
- Available in 2 models; Water-cooled or Air-cooled

For additional information, ask your jobber or write: The Merit Company, 2124 W. Chicago Ave., Chicago 22, Ill.

Sold through jobbers only
Contact:

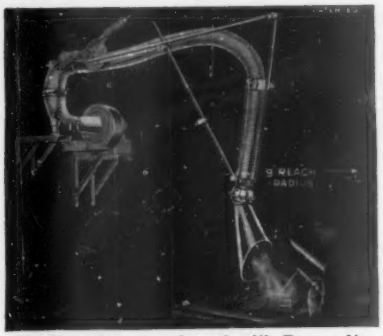
SPOT WELDER DIVISION

THE MERIT COMPANY
2124 W. Chicago Avenue
Chicago 22, Illinois

For More Information Circle No. 65 on Reader Service Card.

Circle No. 80 on Reader Service Card.

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR



Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

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WELDING EXPOSITION

WELDING GLOVES MITTENS AND GARMENTS NOW IN POLY BAGS

BRAZILIAN DEERSKIN THE "STAY SOFT" LEATHER GLOVES AND MITTENS

John Tillman & Company
1561 W. 19th St.
Long Beach, California

Circle No. 92 on Reader Service Card.

Goggles

Two new American Optical coverglas goggles are said to fit 99% of the users. The goggles utilize standard 50 mm. round lenses, to effectively reduce lens stocking problems.

The chippers goggle, No. 325, has perforated aluminum shields, adjustable leather bridge, and is available with either a rigid bar bridge or adjustable rigid bridge. It is supplied with clear lenses.

The welder's model, No. 329, is of identical construction except for indirectly ventilated side louvers. It is supplied with Filterweld No. 5 shade lenses.

Both frames are cellulose acetate in opaque brown.

Circle No. 226 on Reader Service Card.

Portable X-ray Unit

The Norelco PG 300, a new portable industrial X-ray unit that provides high penetrating power and excellent radiographic definition, is available from Philips Electronic Instruments, 750 South Fulton Avenue, Mount Vernon, New York.

Completely self-contained, the new unit is shockproofed, rayproofed and weatherproofed for outdoor operation. Tubehead weighs only 231 lbs.

Emergent beam angle is 40 degrees and focal spot size is 2.3 mm (millimeters). X-ray voltage is continuously adjustable under load in a stepless range from 65 to 300 kv (kilovolts). Load rating is 5 ma (milliamperes) up to 260 kv and 4 ma from 260 to 300 kv. Duty cycle is 100% continuous with water cooling—intermittent with air.

Oil insulated, with inherent filtration equivalent to 4 mm of aluminum, the PG 300 tube head has a diameter of 9⅜ in. and is 47⅝ in. long, including handles. Control cabinet measures 19 in. by 12⅝ in. by 11¼ in. and weighs 77 lbs.

Circle No. 227 on Reader Service Card.

Circle No. 16 on Reader Service Card.

BATEMAN BANTAM IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

PORTABLE SANDBLAST GUN Complete: simply connect to air line

RUGGED—EFFICIENT

$27.50
(Including one spare jet and 2 spare nozzles)

FOR THE LAB OR SHOP

A complete inexpensive sand blast unit for cleaning before and after welding. For sand blasting metal surfaces or small parts. Order one today. It pays for itself quickly.

LINDBERG PRODUCTS CO.
P.O. BOX 908W LAKEPORT, CALIF.

Circle No. 57 on Reader Service Card.

Lift Front Retainer For Welding Helmet

Sellstrom Manufacturing Co. has introduced a new welding helmet lift front retainer. The company says the new Model S nylon plastic retainer features greater infra-red resistance and will hold more plates (welding, safety magnifier and cover glass) without sacrificing its compact design.

Plate changing is simple with a new spring system. The retaining spring is readily accessible and snaps out as desired. By adjusting two screws, plate retainers can be interchanged.

Circle No. 228 on Reader Service Card.

Engine Idler, Self-Starter

Small air-cooled engine welders introduced by The Lincoln Electric Company feature engine speed control and self starting. The welders will accelerate to operating speed instantaneously when the arc is struck and slow to idling speed 8 to 10 seconds after the arc is broken. Engine wear is reduced, and fuel consumption is dropped 10 to 35 per cent with this controlled performance. The self-starter includes starting motor, 12 volt battery, actuating pushbutton, charging ammeter, and charging rate control switch. Charging current is supplied by the welding generator through a special control circuit. Magneto ignition during operation insures snappy engine performance.

Circle No. 229 on Reader Service Card.

Belt Grinding Attachment

A grinding attachment, available for both angle and straight wheel type portable grinders (air or electric) of any make, has been announced by the Nedco Company. The attachment is said ideal for grinding all contours, especially where a straight-line finish is desired. The heavy-duty unit quickly converts an angle type grinder into a belt grinder to make it a dual-purpose tool.

Circle No. 230 on Reader Service Card.

For More Information Circle No. 106 on Reader Service Card.

Quick-acting liquid

WIPES OXIDE AND SCALE from ALUMINUM, STAINLESS STEEL

Use OX-OFF 536 before or after welding to remove scale and oxidation from aluminum or stainless steel in seconds, without costly, time-consuming grinding, scratch-brushing, or sanding. Simply wipe oxide off metal with one or two strokes of hand applicator dipped in Ox-Off 536. Clean small parts by dipping in Ox-Off 536 . . . the polyethylene "cubitainer" in which we ship Ox-Off 536 is your dip tank.

Get free technical bulletins on removing oxide and scale from aluminum and stainless steel from your welding supplies distributor or

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specializing in chemicals for cleaning, chemical polishing, finishing metals
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Buy 3 instead of a pair. Can outlast 2 or 3 pairs.

It took 8 long years to design and perfect this truly interchangeable glove. Finest quality HORSEHIDE full fleece lined. Ask your dealer or write us.

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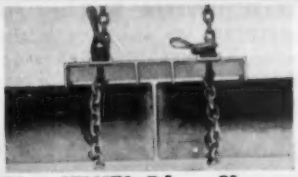

The JEWEL Pipe Clamp
. . . aligns and holds pipe for tacking. Two sizes: ½" to 8" and 8" to 16". Sturdy construction for hard usage.

The JEWEL Elbow Clamp lines up welding elbows from 2½" to 8" at right angles to the pipe and holds them until tacked.

The JEWEL Angle Clamp holds branch line at right angles to the main or headers. Takes any size main or branch from ½" to 12".

The JEWEL Flange Clamp lines up the flange face at right angles to pipe end and holds until tacked. Takes size from 2½" to 16".

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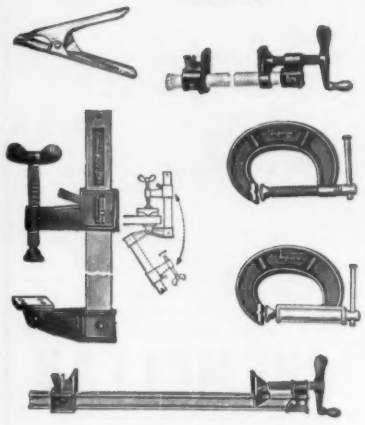

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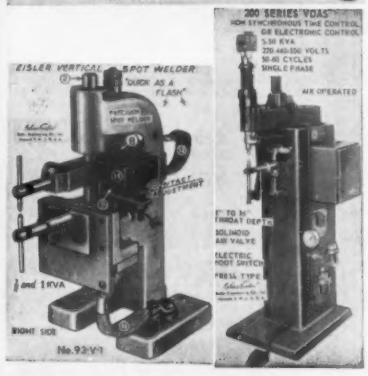

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N.W.S.A. COMMENTS

continued from page 36

are better informed on their products. Since they are only representing a small part of the various items used in the various welding processes, they are better able to discuss the values and merits of their products.

Distributors Answer: The good welding distributor only represents one manufacturer of a major line. His salesmen are trained by the manufacturer and their product knowledge and use of same is equal to that of the direct factory man. It is true that the distributor salesman may be selling other items that are used in the industry. This makes him better qualified; he is in a position to analyze and recommend because of his overall knowledge which is not limited to a small segment of the process. Where you find a distributor handling multiple lines of welding equipment, it is usually due to several reasons. The manufacturer in that given area may be weak and is anxious to get in anyway he can or the distributor may be weak and is willing to take orders for anything he can get. The more enlightened and successful distributor is the one that represents one major manufacturer of a kind. If the user of welding equipment will look for this type of distributor, his requirements can be and will be completely satisfied.

Some Users Feel: That they can buy at a lower price from the manufacturer than they can from the distributor.

Distributors Answer: This may be so in some industries but not so in

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IT'S NEW: SO HANDY

Economical Too

NEW "ROYAL" HARDENING POWDER

In the Shaker Can

"ROYAL" HARDENING POWDER is safe to use. No Toxic fumes. Hardens low-carbon steels equally as well as cyanides.

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the welding industry. All distributors work from a manufacturers suggested selling price sheet and is identical to that used by the manufacturer. Although both sell from the same suggested price list, often times it costs less on a delivered price from the distributor because the distributor may absorb the freight or will only charge freight based on the average of his total stock shipment which is larger than the users orders therefore the freight will be lower.

Some Users Feel: That the manufacturer is better able to protect him from sudden price changes.
Distributors Answer: All prices are usually quoted, subject to change without notice or at best with a 30-day clause. The distributor is usually a better customer to the manufacturer than the user and consequently is in a better position to protect the customer from price changes.

Some Users Feel: That the manufacturer will stand back of the products better than the distributor.
Distributors Answer: The distributor because of his greater volume of purchases from the manufacturer is able to get the manufacturer to bend from his normal guarantee or replacement policy and in all cases can make good faster. The user to the distributor may represent a substantial part of his business, the user may only be another customer to the manufacturer.

Purchasing welding equipment and supplies through your local National Welding Supply Distributor, the user benefits by the following:

• *The Distributor offers prompt delivery from local stock*
Almost one-third billion dollars of welding supplies and equipment are supplies from distributors' stocks yearly. Prompt delivery of your welding needs is offered only by your local Distributor.

• *Consolidating Many Items On One Order-Saves Time and Money*
Your local Welding Supply Distributor saves you money by consolidating many items on one order and one invoice. You need deal only with one dependable source for all your requirements.

• *Emergency Shipments Prevent Costly Shut-downs*
Costly break-downs can give your plant manager gray hair. Your local welding supply distributor offers prompt service on equipment and repair supplies to get production rolling quickly.

• *Capital Investment in Inventory is Reduced*
Why tie up large amounts of money in inventory? You can rely on your local Welding Supply Distributor to quickly fill your needs from his complete stocks.

• *Price and Catalog Information Are Available Immediately*
One telephone call to your local Welding Supply Distributor gives you immediate information on price, availability of stock and technical advice.

• *Purchasing For Current Needs Avoids Obsolescence*
Dealing with your local welding supply distributor enables you to specify quantities that fit your current requirements. Manufacturer's minimum quantities can often force you to overbuy.

• *The Distributor Offers Personalized Technical Advice*
Your local welding distributor has trained salesmen who are familiar with your operations. Whatever the welding problem, his expert advice can help you.

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BENDING BLOCKS or WELDING PLATENS

Semi-steel Blocks for layout, welding assembly work, etc., with machined working surfaces; also tools and accessories, including a full line of clamps, drift pins and dogging devices. Standard and special stands can be supplied. A 4-unit set-up, joined and mounted on stands, is shown above.

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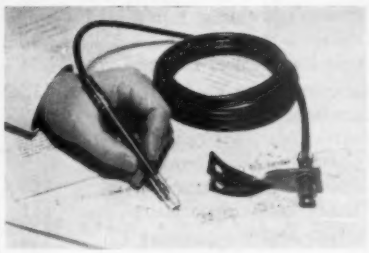
Could you use . . .
A Pencil-Type
Pencil-Size
TIG Torch
for your precision weldments!



Actually, our 1-ounce Model B Argopen is small enough to be gripped and manipulated like a ball point pen. Our customers particularly like the propel-repel collet a ' co-axial power cable hose. The present user net price complete with cable adaptor and instructions is $25.00.

Write us or see your dealer for details.

The Argopen Co.
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IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (190 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

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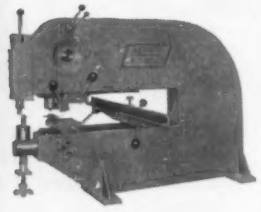

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LM-5

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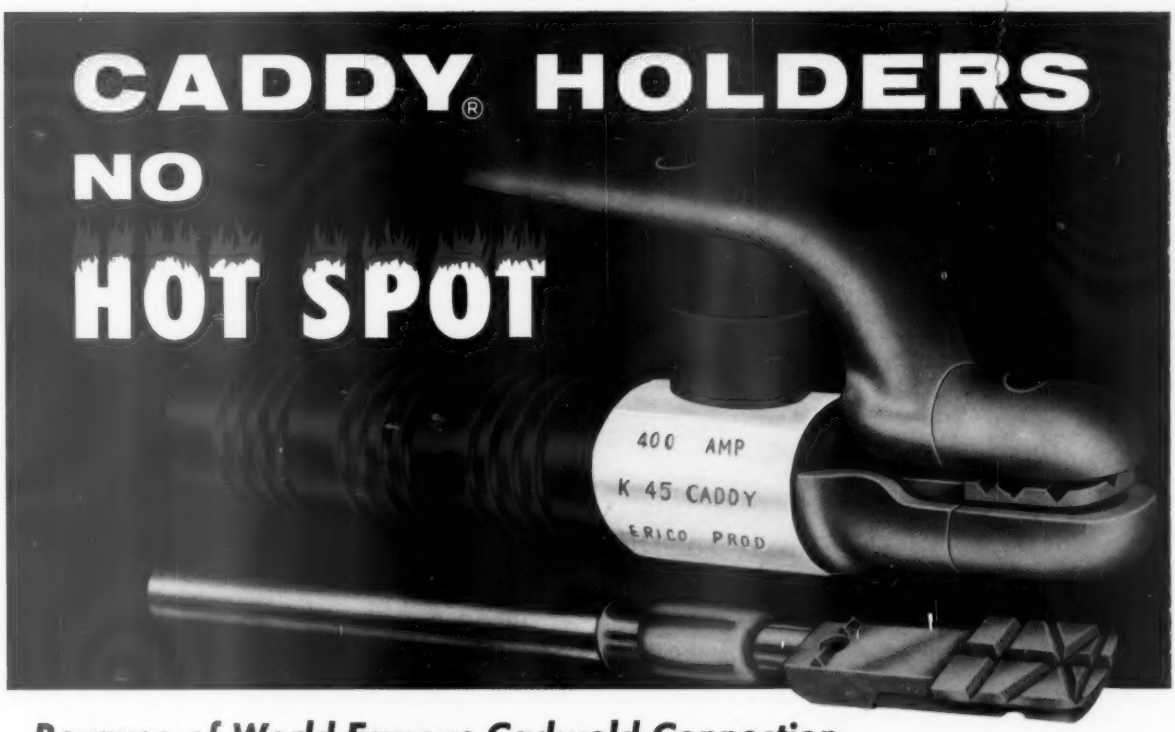
CADDY® HOLDERS NO HOT SPOT



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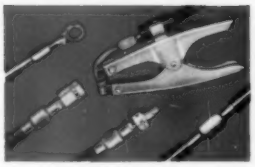

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Gentlemen: ☐ Please send catalog. ☐ Would like demonstration.

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Company_____

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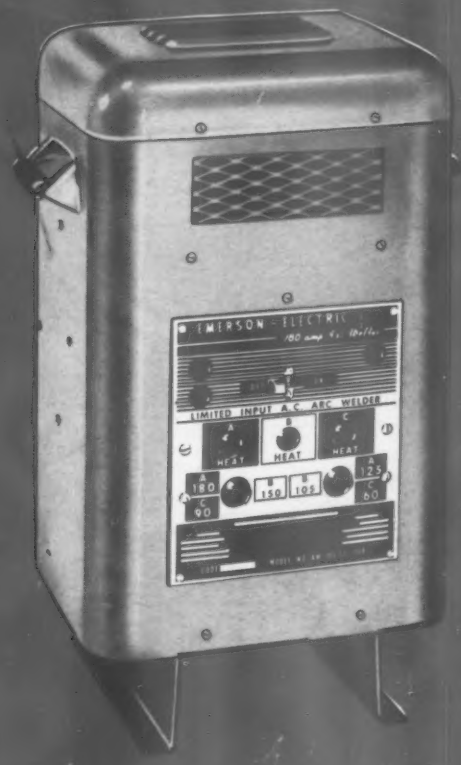
OPENS NEW MARKETS

...MEANS MORE SALES FOR YOU!

180c



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